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COIN 2.0 Formulation

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Introduction

The Department of Defense has long used computational models to support military planning at all levels – strategic, operational and tactical.   Since Cold War planning scenarios assumed the likelihood of attack to be one, those scenarios were focused on either the promulgation of an attack or on the response to or mitigation of one. Computational models of the battlespace thus focused on kinetic aspects of an engagement. Developments in simulation of social environments occurred separately from such battlespace planning. In fact, in most cases, the problem focus for the development of social simulations has been on private or civil sector problems such as the exercise of social capital through social networks, the modeling of crowds or of the behavior of firms or other organizations.

A focus on irregular warfare

The U.S. involvement in counterinsurgency (COIN) and other irregular warfare (IW) activities in the Middle East has changed the military planning focus. No longer is motivation assumed. In fact, in many cases, it is the motivation to attack or participate in some kinetic activity that is of primary military interest.   This has stimulated an interest among military planners and analysts in the modeling and simulation of social environments.

Irregular warfare is defined doctrinally by the Irregular Warfare Joint Operating Concept (IW JOC) as "a violent struggle among state and non-state actors for legitimacy and influence over the relevant populations."[1] In fact, it is this struggle for legitimacy that is the defining characteristic of IW – and therefore of COIN, which is a type of IW.

Since legitimacy depends upon a voluntary (i.e. uncoerced or unrewarded) act of submission to a regime based on the population‟s recognition of its moral authority, the focus of IW is not on control of territory or assets or the exercise of power, but for the „minds‟ of the population. The now iconic redrawing of the Clausewitzian triangle in the IW JOC version 1.0 illustrates this focus on the population (see Figure 1).

Some even argue that the conflict environment has moved so far beyond the Westphalian notions expressed in that triangle that the vertices of the triangle themselves need to be relabeled, as states and their governments are not key relevant players any longer.[2]

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[1] United States. Department of Defense. 2010. Irregular Warfare: Countering Irregular Threats. Joint Operating Concept Version 2.0 17 May 2010 (IW JOC) p.9

[2] Sebastian L.v.Gorka. 2010.   The Age of Irregular Warfare: So What? Joint Forces Quarterly 58 (Q3) Pp.32-38
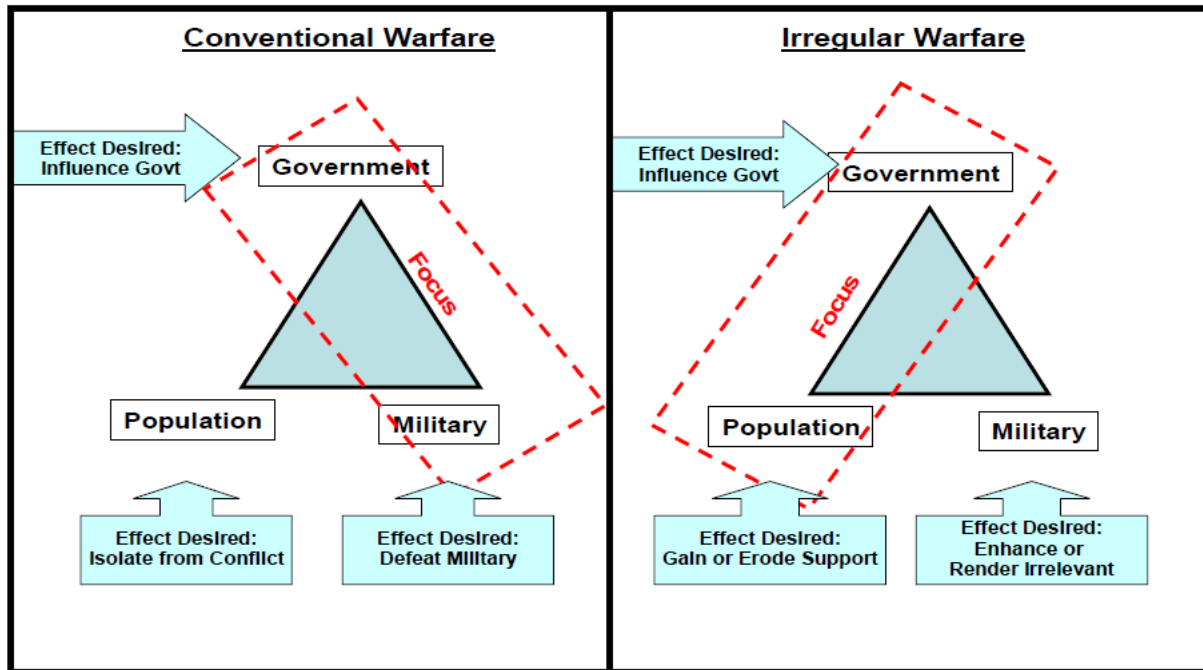
Figure 1: Conventional and irregular warfare[3]

The IW JOC version 2.0 no longer includes the graphic shown in Figure 1 but does argue for a rich understanding of the socio-cultural environment: "The joint force must develop a thorough appreciation of the specific socio-cultural, political, religious, economic, and military factors involved and a detailed portrait of key segments of the population, including those who wield most influence in the society."[4] It goes on to state that "In order to maximize the prospect of success, the joint force must understand the population and operating environment, including the complex historical, political, socio-cultural, religious, economic and other causes of violent conflict.[5] And "A variety of tools such as social network analysis, biometrics, and electronic mapping should be applied systematically to create integrated databases as part of an ongoing effort to gain a comprehensive understanding that will in turn inform planning and operations."[6]

That said, the kinetic aspects of COIN are still of serious interest. In particular, the use of improvised explosive devices (IEDs) by our adversaries has taken a toll on troops, both in terms of lives and morale, and has significantly impacted the conduct of operations.

The U.S."s initial responses to IEDs focused on finding and disabling the devices. Military planners and others soon realized that this was a game of catch-up, which would be difficult to win. While not abandoning efforts in this area, U.S. attention has broadened to include efforts to understand and disrupt the socio-technical processes that lead to the manufacture and

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[3]U.S. Department of Defense. 2007. Irregular Warfare (IW) Joint Operating Concept (JOC). Version 1.0. 11 September 2007. P.8
[4] U.S. Department of Defense. 2010.   op.cit. p.25
[5] Ibid.. p.5
[6] Ibid. Pp25-26

implantation of IEDs – to move „left of boom." Hence there is an interest in computational social modeling.

The challenge problem

This shift in perspective requires the development of an understanding of the social dimension of this problem as well as the kinetic. We have addressed the intersection of these two spaces. We phrased the challenge for this project as the *development of a computational representation of the interdependence between kinetic and non-kinetic aspects of a battlespace.* As such, our model will need to include representations of not only red (adversarial) and blue (friendly) forces, but also the civilian population (green) and the interactions among these three players.

While the initial application for this work will certainly be venues in Iraq and Afghanistan as these are of immediate concern for the U.S., our purpose is not to specifically replicate a particular environment or to be able to predict the behavior of individuals in some particular space-time. We see this model as a strategic tool, rather than a tactical one. If we are successful, the model will help planners think about the problem at large, to generate scenarios that will broaden the possibility space with which they will engage. It is not designed to help solve particular problems in particular battlespaces.

That said, in order to construct the model, we will need to spatially locate it so that we can use a real data set to determine the utility (the „goodness") of the model. While the model structure should be broadly applicable, all behavior plays out in context-specific permutations. We thus developed a model structure grounded in social theory, which we support with arguments from the literature. We then use data to modify the theory as appropriate to a particular time and place, as depicted in Figure 2.
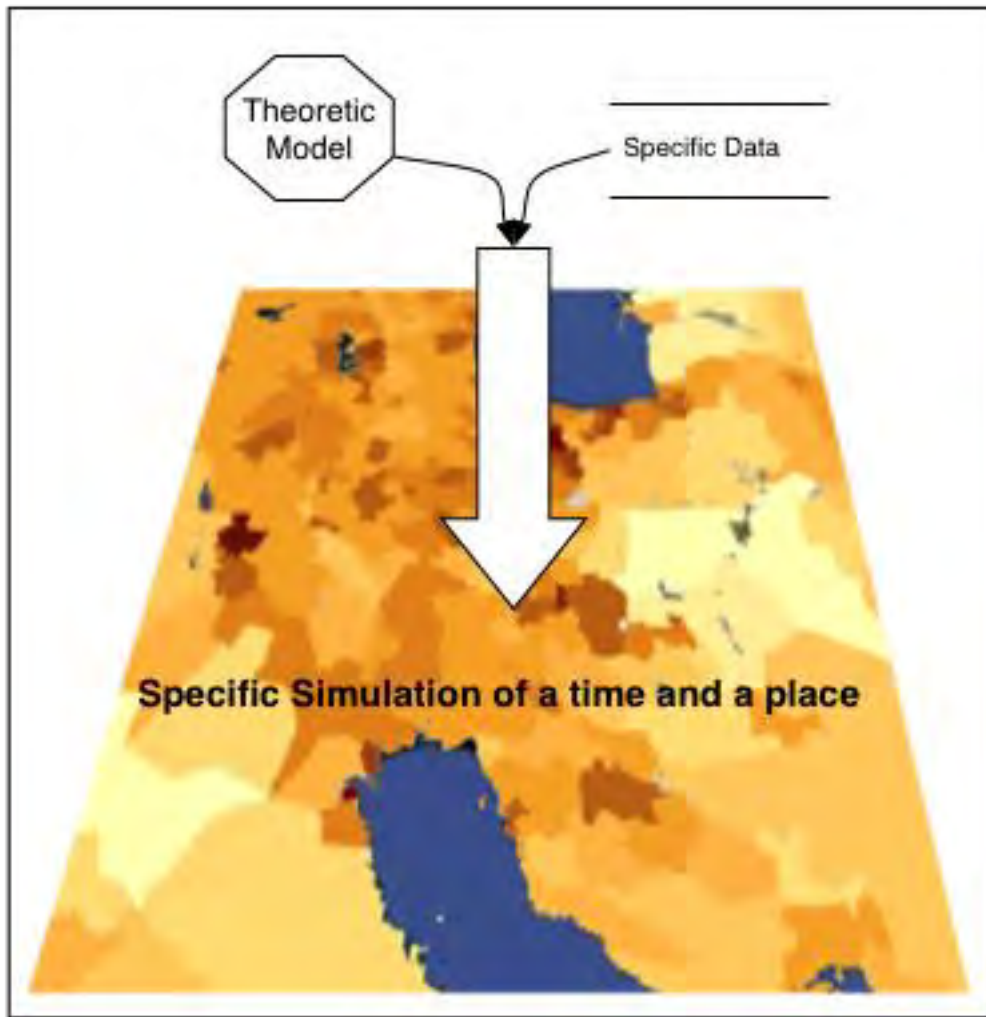
Figure 2: A theoretic model populated with specific data allows one to examine the dynamics in a particular place at a particular time. This allows the model to be culture-general and useful. The geospatial image was taken from Google Earth's depiction of population density.

For obvious reasons, our particular time and place will be the Middle East, specifically Iraq and Afghanistan. Those two geo-cultural areas, while similar in many ways are culturally and socially distinct enough to allow us to do an initial test of the robustness of the model structure. (A full test would require its application to some distinctly different culture area such as Colombia or Thailand.) Coalition military activity in the Middle East has given us a wealth of data on Blue forces, a reasonable amount of data on Red forces – and highlighted the paucity of data available to the military at the strategic and operational levels on the cultural and social dimensions that are so critical in COIN or other IW activities.

Although this model is geospatially located for development purposes, it is positioned as a „culture general" model not a regional model. In brief, a culture-general approach will lead to cross-cultural competency - the ability to quickly learn to operate efficiently in any culture. Culture-specific or regional knowledge equips one to behave appropriately in a particular

culture.[7] So a culture-general model encapsulates principles (as distinct from rules) that are manifested differently in behavior wherever they are generated, but which apply generally across cultures. The specific values applied to parameters are what instantiates the model for a particular cultural environment.

One of our aims with this model was to help us differentiate between behaviors that look the same, but which are driven by different motivations. This will help us better understand how to achieve strategic goals such as the development of legitimacy. It also will help on the operational level, illuminating such phenomena as counter-government behavior driven both by ideology as well as more instrumental factors such as local power struggles or financial needs. This could help us devise different means to manage the „good guy by day, bad guy by night" phenomenon. It should also help us understand how certain of our own actions (such as the choice of to whom we will provide resources) will influence motivations and hence behaviors of members of the local population. Ultimately, we are interested in the relationship between what have come to be called stability operations (previously known by other terms such as „nation-building") and kinetics, and the relationship between power (the ability to coerce or provide benefits) and legitimacy (the perception of fairness of government processes).

Organization of the document

We begin our description with what we have called the „high level story." This is a presentation of the narrative which provides coherence to the model, introducing the actors (agents), their possible behaviors, and their relationships. We then give a brief explanation of the kinetic aspects of our model. The section which follows explicates and justifies the narrative presented in the high-level story with support from the literature for the model structure. We then explain the integration of the social and kinetic dimensions of our model, and outline in our conclusions section some important dynamics around our challenge problem that our model can illustrate. Where necessary and appropriate throughout, we ground the abstract structure with data from the Middle East.

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7 Jessica Glicken Turnley. (in press). Forward deployed warrior diplomats: Special Operations Forces and Cross-Cultural Competence (working title). Joint Special Operations University, US SOCOM. Hurlburt Field, FL.

The High-Level Story

Here we introduce our story. In the section following this which explicates the story in depth, we will give details on how the agents are structured, their allowable interactions, the parameters that constrain that interaction, and provide support from the literature for our constructs. In this section, we focus on developing our narrative thread.

The narrative

In brief, our story is that in any COIN environment, there are three types of players (see Figure 3). There is an established regime, opposition to that regime, and the local population who may be neutral or lean slightly towards or away from either of the other two players. For example, in our construct there is a host nation (the established regime) which is supported by other geopolitical players. We call this actor the *Coalition*. There is a group opposed to the Coalition, also operating with international support, which we call the *Foreign Fighters*. Finally, there is the *local population*, the „prize" in any insurgency environment. The local population presents a shifting landscape of groups that form and reform based on connections members establish as they try to achieve various social goals. The Coalition and Foreign Fighters compete for the allegiance of the local population, allegiance expressed in our model by certain actions the local population takes. The actions the local population takes are driven by their roles in society, and are impacted by the actions of the Coalition and the Foreign Fighters and by the violence represented by IEDs.
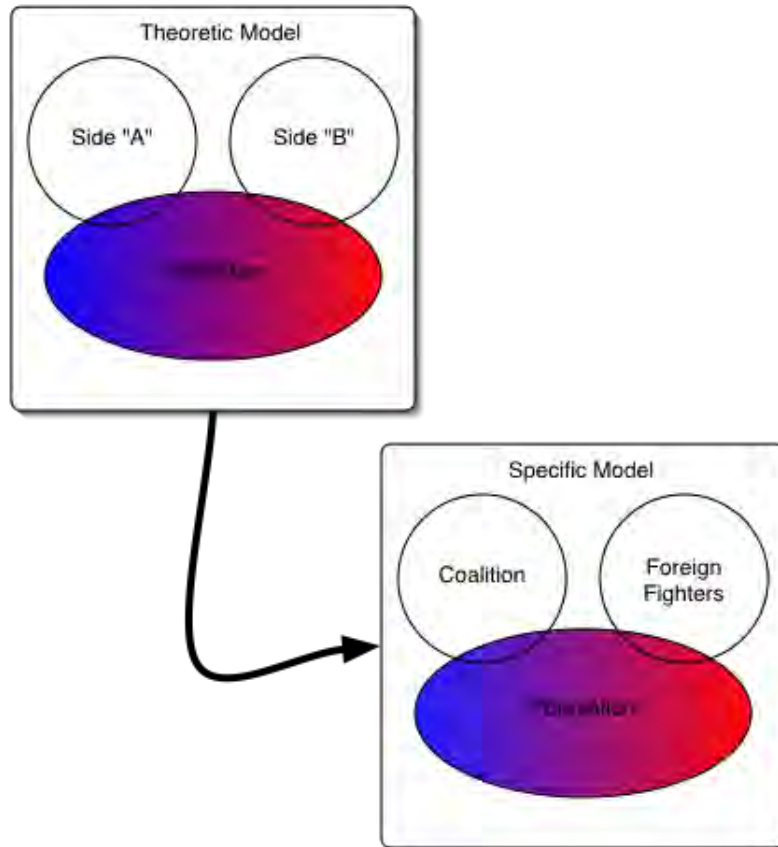
Figure 3: The most basic components of our model: two opposing sides and a population.

Our model has a rich social landscape within which the local population operates. In our story, a member of the local population assesses how well off he is in relation to others in his social space. He acquires a belief about who is responsible for his perceived quality of life, and who caused people he cares about to come to harm. He has some inherent level of risk aversion which will constrain the types of actions he is willing to take. These actions include both social actions such as joining various types of groups and kinetic actions such as making and detonating IEDs.

Meanwhile, the Foreign Fighters and the Coalition are imposing harm on the local population in the form of arrests, kidnappings, killings and the like. They also are providing benefits to that same population in the form of "cash" or other benefits of the type the U.S. describes in various discussions of stability operations. The Foreign Fighters and the Coalition also are harming each other. In our model that is represented only by the harm caused by IEDs and direct fire casualties.

The Coalition"s goal is to reduce overall violence and to reduce the number of members of the local population who join Foreign Fighter-affiliated groups. The Foreign Fighters" goal is to inflict as much damage as possible on the Coalition and to increase the number of members of the local population who join Foreign Fighter-affiliated groups.

Since our model run only covers six months, no members of the local population are replaced if killed. Births, immigration, emigration or other mechanisms of growing a population are not included in our model. However, members of the Foreign Fighters and the Coalition are replaced at some exogenously determined rate with some specified exceptions.

The model makes a suite of actions available to all of the actors within this context. The simulation shows how factors combine into scenarios and how those scenarios play out.

Explicating the high-level story

The previous section described our narrative thread. Here we explicate critical portions of it, supporting our argument with references to the literature. We first describe our actors – who the players in the model are and how they describe themselves. We then discuss the principles by which they interact.

It is important to note that we are not modeling specific individuals and their particular belief structures – only representative individuals as they instantiate collectivities. (To say it another way, we are not modeling individuals as psycho-social actors, but as instantiations of different sets of socially constructed norms.) An observer could not „match" an agent in our model with a particular „real" individual. Rather, he would find in the model a „Pashtun Durani" actor who „believes" certain things about the Coalition as a consequence of his Pashtun-ness, and Durani-ness – he has a Pashtun stance or attitude, and a Durani stance. As a consequence, this model cannot be used at a tactical level to predict specific scenarios with identifiable actors, but it can be used to derive strategic or operational approaches and interventions.

One of the major dynamics underlying this model is that our actors (like people) organize themselves in groups. In our model, some of these groups act together as a collectivity, others cannot. Some of these groups channel resources (described as costs or benefits) as do some individuals, others do not.

Groups are predefined by sets of specific behaviors. Some of these groups which we call „jobs" look like traditional employment sectors – police, government, agrarian labor, etc. Others groups have a more diffuse nature such as civic groups or religious groups. Finally, some groups emerge in the local population from the dynamic interaction of individual members. All of these group types are illustrated in Figure 4.
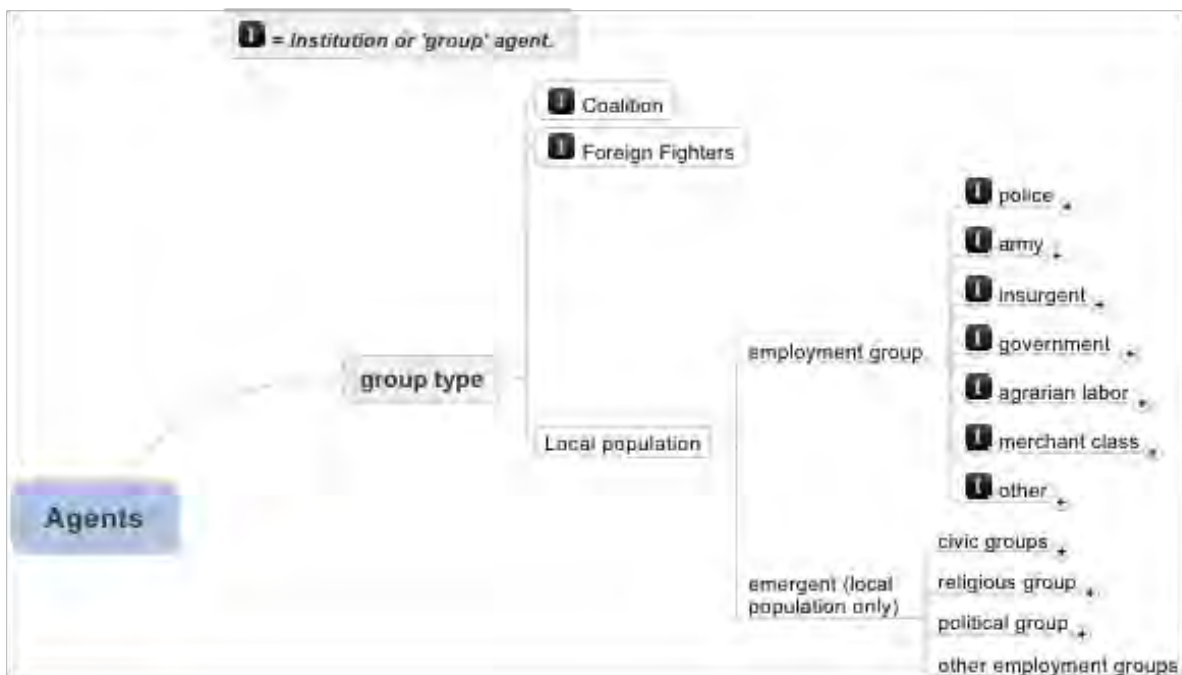
Figure 4: Group types

Actors

We start with the three players in a COIN world. We define them as mutually exclusive high-level actors who exist in both social and geo-physical space: Foreign Fighters (in a generic COIN sense, those fighting the established regime), the Coalition (those supporting the established regime, including the host nation), and the local population (refer to Figure 3). Each of these high-level actors is actually a collection of individuals who also perform as individual actors. These members, in turn, belong to various groups.

In our story, Foreign Fighters and the Coalition are actors of a *different kind* than the local population. Foreign Fighters and the Coalition, as collectivities, can act as independent actors, although (as we shall see later) their scope of action is relatively limited. That is, the Coalition *qua* Coalition can „do something." The local population, on the other hand, does not act as a collectivity, although its jobs, such as „army," ‚police," „farmer," and „insurgent" may function as collectivities.

There are other differences as well. The individual members of the Foreign Fighters and the Coalition each hold mutually exclusive jobs such as bomb maker or patrol agent – that is, so long as a member holds one job he cannot hold another. Members of the local population, on the other hand, can hold several jobs and belong to several groups simultaneously. We thus lay the foundation for a rich social environment for the local population.

Members of the local population can simultaneously operate in up to four different social domains: employment, religious, civic, and political. The religious, civil and political domains

have actions identified at the domain level. One of the actions that a member operating in the political domain can take, for example, is to provide human intelligence (HUMINT) to either the Coalition or the Foreign Fighters. The employment domain is further differentiated into several different jobs ranging from merchants to insurgents, each of which has particular actions associated with it. Each of these jobs can act as a collectivity (that is, as a social actor in its own right), and the individuals within the collectivity can take actions independent of each other and of the collectivity. Of particular interest to us is the insurgent job, as one of the actions that a member of the local population can take as an insurgent is to become a bomber and support the Foreign Fighters. Finally, there are groups which emerge and recede as a consequence of interactions among members of the local population.

Our set of actors is illustrated in Figure 5. Note that any box identified with an „I‟ is a collectivity that can function as a social actor.
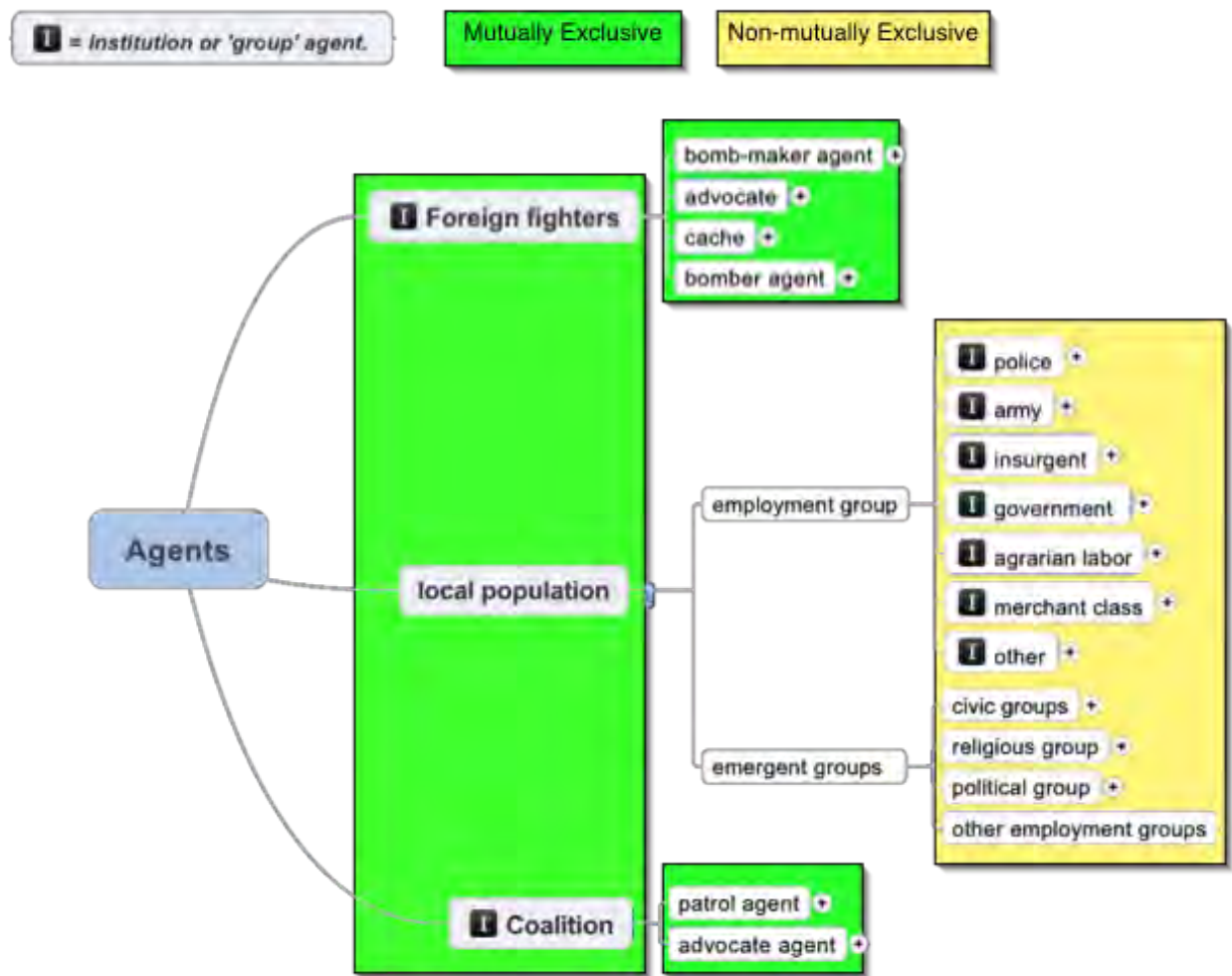
Figure 5: Actors

Foreign Fighters

Foreign Fighters is a more developed actor than the Coalition. Members of the Foreign Fighters can have one of four different jobs. They can be bombers, in which case their possible actions are to find a cache, acquire an IED, emplace an IED, arm an IED, trigger an IED, and perform battle damage assessment (BDA). They can be bomb-makers, in which case their possible actions are to locate a cache, make an IED and to relocate to a new cache if necessary. A cache is treated as an active agent. Its action is to store IEDs. And finally, there is an ‚advocate" job. Advocates provide benefits to individuals, and impose costs on individuals in terms of killing, injuring, or kidnapping them. We have left benefits unspecified in the model, but example benefits might include food and medical care for members of the local population. The Foreign Fighters as a collectivity also can provide resources to other groups, or to an individual.

Figure 6 illustrates the Foreign Fighters, their jobs and their possible actions. The ‚A" designates an action.
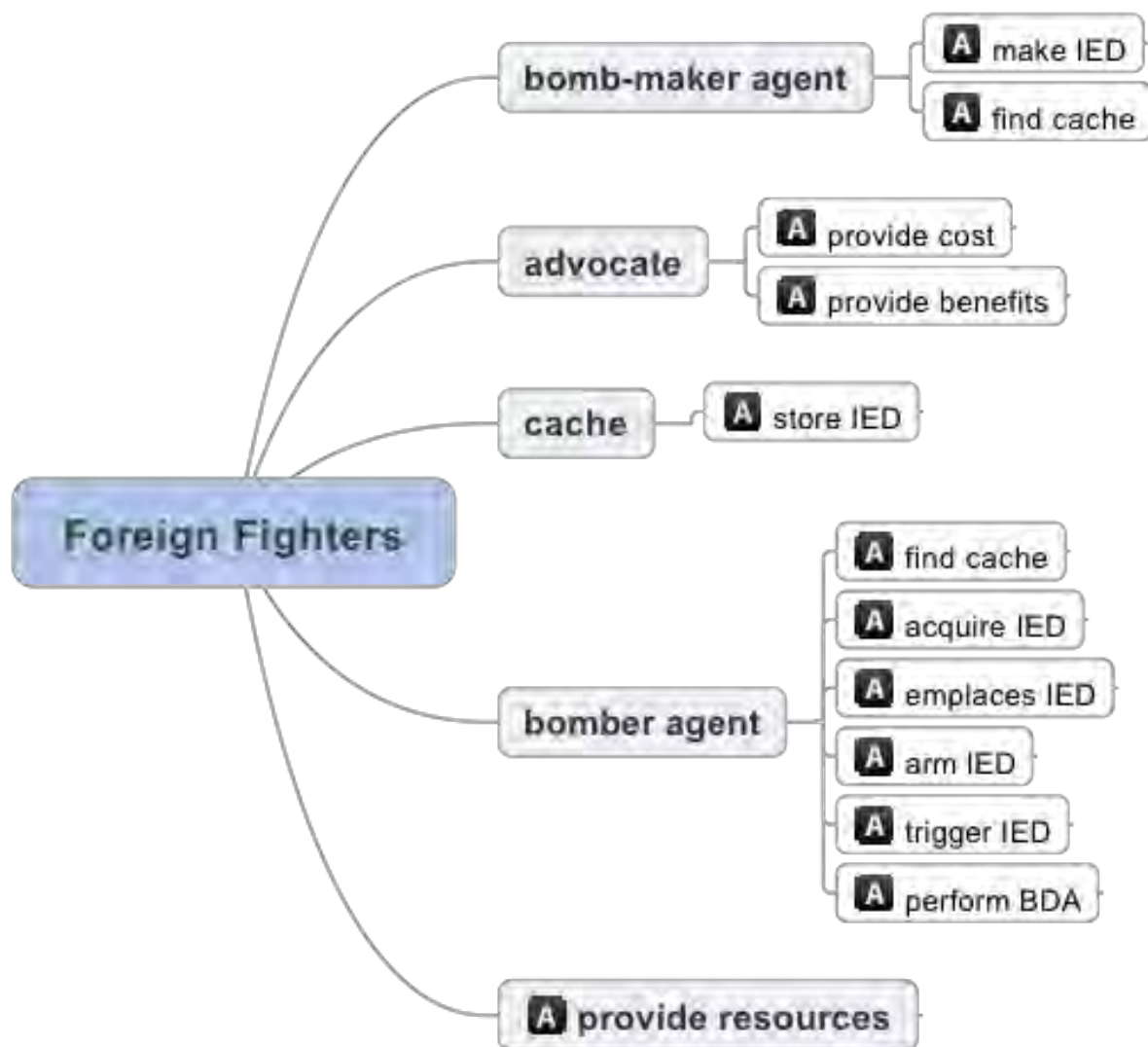
Figure 6: Foreign Fighter agents and their possible actions.

The Coalition

The Coalition also can act as a collectivity. Similar to the Foreign Fighters, as a group the Coalition can provide resources to groups or to individual members of the local population. Members of the Coalition can have one of two jobs. They can be a patrol agent or an advocate agent. If acting as a patrol, the member can go on a patrol, execute a convoy mission by moving in concert with other patrols, execute a named operations mission which involves moving to and destroying a cache, or perform BDA after being attacked with an IED. A Coalition advocate will provide benefits to and impose costs upon individual members of the local population. As with the Foreign Fighters, costs include arrest, injury or death, and benefits are unspecified. Figure 7 illustrates the Coalition and its various jobs and actions. Again, „A‟ designates an action.

Figure 7: Coalition agents and their actions

Local population

The local population is the most complex group of actors in our model, although it itself does not act as a collectivity. (The local population *qua* local population cannot „do‟ anything.) This section defines several terms which help us draw the picture of the local population. These terms individuate members of the local population, and establish the principles of the dynamics by which they will interact.

We will first discuss how members of the local population define their *social identity* through combinations of attributes which are assigned various weights. We then will explore a social dynamic called *homophily*. Homophily explains how individuals form social connections by assessing their similarity (likeness) based on different kinds of comparisons of their attributes. Once these connections are established, individuals then compare themselves to those with

whom they are connected to determine their relative deprivation or *hardship*. They also develop an assignment of blame for their hardship, an assignment we call a *stance*. Their hardship combined with their stance (how badly off they believe they are and who they think is to blame for that) yield their *grievance*.

Members of the local population are further individuated by their *risk attitude* (a propensity for risk or, as more commonly stated, their level of risk aversion). An individual"s grievance combined with his risk attitude will tell us in what types of activities he would be willing to engage – whether he would be pro- or anti-Coalition, for example, and if he would be likely to engage in kinetic activities (e.g. detonating an IED) or more passive activities (such as providing HUMINT).

Defining social identity

Recall that in our model, unlike the Foreign Fighters and the Coalition, the local population cannot act as a collectivity. The local population, itself, is not an actor. Also unlike members of the Foreign Fighters and the Coalition, each local population agent is given attributes that contribute to the individuation of its actions.

The current model has identified eight attributes associated with local population agents: ethnicity, tribal affiliation, religion, nationality, gender, marital status, age cohort, and wealth. Values for these eight attributes are assigned to the general population agents at the beginning of a model run.

Values are determined for the attributes based on the area of interest. We had said earlier that we are developing a culture-general model, not one that is specific to a particular time and place. One of the ways we achieve this is to allow the attributes, which define the members of the local population and constrain their behavior, to be differentially weighted according to their relative impact on social interaction depending upon local culture and norms. For example, in some cultures like ours marital status receives relatively low weight. In other cultures, it receives extremely high weight, highly constraining the set of individuals with whom one may interact, particularly when combined with gender. (Unmarried women, for example, are much more constrained in some cultures than unmarried men or than married women.) Appropriate definition of this set of attributes for a particular application of this model thus requires a reasonable amount of time- and space-specific knowledge as cultures (and so this set of attributes and their weights) do change over time as well as across space. For example, in Afghanistan, the weight given to the nationality attribute probably differs depending upon locality. Along the Afghanistan-Pakistan border, for example, it may matter very little, while in Kabul it may be very important. As another example, in Iraq religion might be differentiated by Sunni/Shi"a, tribal affiliations would be determined by the locality, and ethnicity might be given values of Arab/Kurd, etc. In Afghanistan, religion also would show a Sunni-Shi"a differentiation, tribes would be determined by the locality, and ethnic group would have many more values (e.g. Pashtun, Tajik, Hazara, Uzbeck, etc.) than it does in Iraq.

Homophily

Within any social landscape, humans tend to connect with others who are „like" them. Local population agents use their attributes to help determine this likeness. That said, „like" can be defined in a variety of different ways. Analytically, this „likeness" is referred to as homophily, which serves as a key contributor to the dynamic of our model.

<u>Homophily defined</u>

People live in social space. In this space, they engage with others who are „like" them. We use a more nuanced definition of homophily than is usually found in the computational modeling literature, as we return to the original definition of homophily as developed by Paul Lazarsfeld and Robert Merton.[8]

Lazarsfeld and Merton defined two different types of homophily. Status homophily refers to "observed tendencies for similarity between the group-affiliation of friends or between their positions within a group"[9] or *similarity in structural position*.[10] In our model, we have used wealth, marital status, age cohort and gender attributes as markers of the agent"s social structural position. Value homophily, on the other hand, refers to "observed tendencies towards correspondence in the values [of others]"[11] or *similarity in values*. In our model we have used the ethnicity, tribal affiliation, religion and nationality attributes as indicators of clusters of values. So our members of the local population have four status-defining and four value-defining attributes, each of which has some range of values.

Status homophily often is recognizable through visible markers such as dress, language, etc. Value homophily is not. According to Lazarsfeld and Merton, it is generally status homophily that stimulates an initial connection. Even if people discover later that they hold incompatible values, Lazarsfeld and Merton found that the affective connections developed through initial status-defined relationships may override the value differences. Therefore, the (lack of) effect of value homophily on a given relationship is a function of the strength of any relationship that existed prior to the participants" exploration of value homophily. The strength of the *a priori* relationship (if there is one) may depend, to a greater or lesser degree on the strength of the status homophilitic connection, and on the length of time the relationship has been in existence.[12]

For our modeling purposes, this does two things. First, it establishes two different ways in which members of the local population may ascertain similarity. They can be like one another in that

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[8] Paul F. Lazarsfeld and Robert K. Merton. 1978 (1954). Friendship as Social Process: A Substantive and Methodological Analysis. in Freedom and Control in Modern Society. Morroe Berger, Theodore Abel and Charles H. Page, eds. Octagon Books. New York, NY. Pp. 18-66

[9] Ibid., p.24

[10] It is interesting to note that there has been a recent surge of interest in structural similarity in social network studies. It is now called „structural equivalence" and is generally studied as a discrete phenomenon. See for example Ronald Burt who argues that physicians (his case study) may adopt a new drug through a phenomenon he calls contagion. Although the physicians may never meet face to face they „engage" with each other by virtue of a common position in the social structure and adopt a new drug because of behaviors expected of someone in their positon. Ronald Burt. 1987. Social Contagion and Innovations: Cohesion versus Structural Equivalence. The American Journal of Sociology. Vol.92. No.6. Pp.1287-1335

[11] Lazarsfeld and Merton op.cit P.32

[12] Ibid.

they occupy similar positions in the social structure, or they can be like one another because of a correspondence in values. Secondly, they assess these two types of similarity sequentially, assessing structural similarity first, then value similarity. The time between these two assessments can range from virtually immediate to practically infinite. It is possible that two individuals never do assess value similarity but simply build a relationship based on their structural similarity.

Homophily in action – the theory
The social consequences of status and value homophily are explained by reference to two theoretical traditions. Status homophily draws on identity theory, while value homophily pulls from social identity theory. Although these two sound similar in name, they treat social identity and its relationship to group formation and membership very differently.

Identity theory, originally formulated by Sheldon Stryker in 1968,[13] is a sociological theory which argues that an individual defines his self in terms of how well he fulfills the expectations of the various social roles from which he may choose.[14] A social role is a set of expectations prescribing behavior that is considered appropriate by others. We refer to these discrete sets of expectations with terms like „father," „married," „hobo," or „wealthy man." When these expectations are internalized, they become part of an individual's identity.[15] This approach thus suggests a definition of self in terms of others' (or society's) behavioral expectations. In fact, roles are often defined counter-positionally, that is, in contrast or opposition to another. (A „father" is not a „mother"; a „policeman" is not a „citizen," etc.) The complete set of these expectations in a given time and place is a description of social structure.

Identity theory argues that social roles in and of themselves do not carry behavioral expectations. They carry such expectations only as they are specifically instantiated in time and place.[16] For example, there are no expected behaviors of a general member of a generic tribe, for example, but there are expected behaviors of a father in the Jibur tribe. Cartoon versions of social roles are delineated in our model by the confluence of our four status-homophilitic attributes (gender, marital status, wealth, and age-cohort) when they are weighted appropriately for a particular time and place.

Social identity theory is different than identity theory. Social identity theory focuses on the way in which social categories provide definitions of self and so influence values and attitudes.[17] Social identity theory suggests that individuals act as and are perceived as representatives of groups rather than as unique selves.[18] The focus is on intergroup interaction. Again, cartoon

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[13] Sheldon Stryker. 1968. Identity Salience and Role Performance. Journal of Marriage and the Family. Vol.4 Pp.558-564

[14] Michael A. Hogg, Deborah J. Terry and Katherine M. White. 1995. A Tale of Two Theories: A Critical Comparison of Identity Theory with Social Identity Theory. Social Psychology Quarterly. Vol.58, No.4 Pp. 255-269. P.257

[15] Sheldon Stryker and Peter J. Burke. 2000. The Past, Present, and Future of an Identity Theory. Social Psychology Quarterly. Vol.63, No.4. Pp.284-297. P.286

[16] Hogg, et.al. op.cit. P.257

[17] Henri Tajfel. 1982. Social Psychology of Intergroup Relations. Annual Review of Psychology. 33:1-39

[18] Hogg, et.al. op.cit. P.261

versions of these types of groups in our model are provided by the values assigned to the value-homophilitic attributes of religion, ethnicity, tribal affiliation, and nationality.

Social identity theory addresses the *process* of identification with groups, including the formation of stereotypes, the positive valuation of in-group behavior and the negative valuation of out-group behavior. Identity theory, on the other hand, is structural and descriptive. It does not assign value. It focuses on descriptions of the roles themselves and their manifestation through behavior.

The type of self-identification described by social identity theory (self-identification as a member of a group) is more likely to lead to group conflict than is the type of identification developed through role behaviors. In social identity theory, in-group and out-group behaviors become prototyped, stereotyped, and valued. In identity theory, in contrast, the primary dissonance is between individuals who do not agree on role expectations.

Homophily in action – the model

This distinction between status and value homophily described above corresponds to the two mechanisms in our model which allow agents to become individuated.

Individuals who exhibit status homophily in our model comprise what we call a *status group*. These groups are defined as described by identity theory. Local population agents will check the values displayed by other local population agents for gender, marital status, wealth and age cohort. The more they match those of the agent doing the checking, the more likely are two agents to establish a connection.

Individuals who exhibit value homophily in our model comprise what we call a *value group*. These groups correspond roughly to groups of the type described by social identity theory. As such, we look for homophily between agents in terms of ethnic groups, tribes, religion and nationality. Table 1 illustrates the relationships among these concepts.

Table 1: Status and value homophily

Status homophily	Value homophily
Status group	Value group
(marital status, gender, wealth, age cohort)	(tribe, ethnicity, religion, nationality)
Identity theory	Social identity theory

Finally, recall that we said that our actors move in geo-physical as well as social space. Homophily also comes into play as we map the geo-physical dispersion of our actors. Neighborhoods, whether rural or urban, tend to be relatively homogenous. (Think of „Little Italy" or „Chinatown" or „Little Saigon" in any of our major urban areas.) While we do not have

time (nor would it be useful) to go into the reasons for this here, we note that this homogeneity is due to the exercise of social capital, a phenomenon of social connections.[19] Simple models have shown that a relatively low level of homophily-seeking behavior can result in highly segregated neighborhoods[20] where the homogeneity could be along either status or value dimensions.

In the real world, a person will use homophily to determine with whom in his geo-social space he will engage. We reflect this in our model through the use of Kathleen Carley's concept of relative similarity[21] to determine whether or not two actors will actually engage with each other and exchange ideas. As does Carley, we do not differentiate between status and value homophily traits to determine *whether* two individuals will interact when they meet in their geographic space. However, we do differentiate between status and value homophily in making a determination as to *what the result* was of any interaction that did take place. For example, if the relative similarity calculation indicates that the two actors would indeed interact with each other because they have enough traits in common, then the importance of whether the two actors share status homophily or value homophily or both comes into play. If they share status homophily, they will affect each other's perception of relative hardship (discussed in the next section). If they share value homophily, they will affect each other's stances (discussed in the section following Hardship).

Hardship

As an individual engages with those in his status group (those with whom he has high status homophily), he gains information about his own social condition or quality of life relative to theirs. This allows him to determine what is called his relative deprivation or perceived hardship. Robert Merton, who introduced the term, argued that relative deprivation is "primarily utilized to help account for feelings of dissatisfaction, particularly in cases where the objective situation would at first glance not seem likely to provoke such feelings."[22] In these cases, an individual compares himself to others, not to an objective standard, in order to determine his satisfaction.

Treatments of relative deprivation draw heavily on reference group theory, which addresses the selection and use of certain social groups by an individual in the process of identity formation. An individual could compare himself to members of his own group (called egoistic comparisons) or to groups of which he is not a member (a fraternalistic comparison). This has echoes of our earlier discussion of social identity theory and how these types of comparisons impact one's identity.

Figure 8 shows this series of actions as we have represented it in our model. Note also that as hardship is a relative phenomenon, it will vary over time as those in the social space the individual surveys varies.

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[19] Elizabeth Fussell and Douglas Massey. 2004. The Limits to Cumulative Causation and International Migration from Mexican Urban Areas. Demography. Vol.41, No.1. Pp.151-171. P.152

[20] Thomas Shelling. 1978. Micromotives and Macrobehavior. W.W. Norton and Company. New York, NY. pp. 135-166.

[21] Carley, K. (1991). A Theory of Group Stability. American Sociological Review , 56 (3), 331-354.

[22] Robert Merton. 1957. Social Theory and Social Structure. (Revised and enlarged edition). The Free Press. New York, NY. p.235
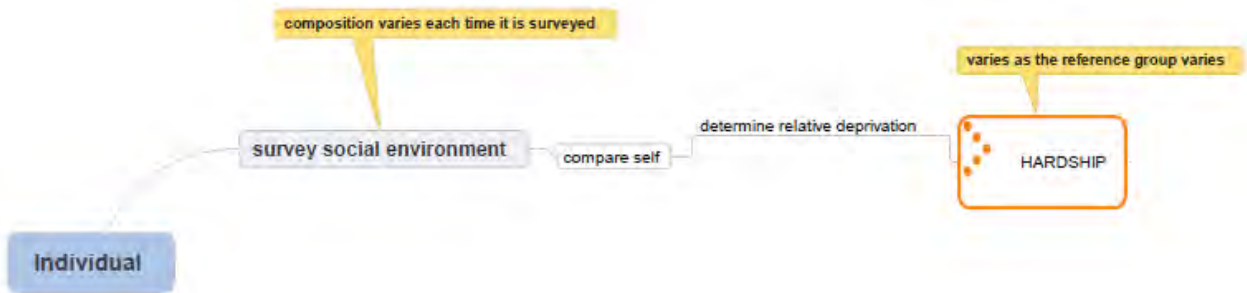
Figure 8: Determining hardship

Notions of relative deprivation have social consequences. Efforts to correct egoistic instances of relative deprivation are likely only to affect the target, whereas efforts to correct fraternalistic deprivation are likely to lead to social strife or to stimulate the rise of large social movements.[23,24,25] When these perceptions of hardship are combined with attitudes of „blame‟ for that hardship (which we address in the next section on stance), the possibility of social unrest increases.

The tendency to *relatively* determine hardship has some interesting implications for social programs that target improvements in quality of life (including those outlined under the rubric of stability operations). Programs that exhibit equity in application, i.e. that target all segments of the population equally, are likely to fail to raise satisfaction or happiness in any segment. While they might address issues of *absolute* deprivation, they do nothing to address *relative* deprivation. Relative deprivation may also be temporal. A government, which promulgates promises of improvements that are subsequently unmet for whatever reason, runs a high risk of facing social unrest. In a slightly different type of temporal relative deprivation, a group that experiences economic growth or an expansion of rights, followed by stagnation or recession of those processes also may experience 'relative deprivation.' This phenomenon is also known as unfulfilled rising expectations.[26] This is similar to the case where programs fail to deliver. In the case of the failed programs, the expectations of future benefit are made explicit; in the case of expanding economies, the expectations are implicit, but nonetheless very real. It is this temporal social deprivation that has most often been cited by social scientists as the stimulus for violent social movements such as insurgencies or civil war, or for socially deviant behavior such as crime.[27,28] Thus, the way in which hardship or relative deprivation is addressed through programs

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[23] Walter Garrison Runciman 1966. Relative deprivation and social justice : a study of attitudes to social inequality in twentieth-century England, University of California Press. Berkeley, CA.

[24] Merton, Robert K. 1938. "Social Structure and Anomie." American Sociological Review 3 (1938): 672-682..

[25] Ted Robert Gurr. 1970. Why Men Rebel. Princeton University Press. Princeton, NJ.

[26] Diana Kendall. 2005. Sociology In Our Times,. Thomson Wadsworth.

[27] Merton, op. cit.

[28] Gurr, op.cit.

like stability operations has the potential to invalidate the operation itself or to garner support among the local population for the regime providing the resources.

Stances

A stance is an expression by an individual of whether or not he holds some particular group responsible for his condition, whether his condition be good or bad. This is distinguished from hardship which is his perception of that condition. A member of the local population will consider what he knows about the imposition of costs (including deaths and injuries from IEDs and arrests/kidnappings from enforcement actions) and benefits by various actors (including the Foreign Fighters and the Coalition) on his value group when determining his stance. His stance will vary over time.

An individual actor‟s stance is a function of his own stance and the stances of those with whom he engages and the stances of the groups to which he belongs. (We will discuss how groups develop stances later.) In our model, as an individual actor engages with those in his value group (those with whom he has high value homophily), he may change his stances based on the directionality and strength of his own stances and the stances of those with whom he interacts.

Grievance

The combination of an actor‟s perceived hardship (determined as a function of his relative deprivation) and his stances will yield his grievance level. An actor‟s grievance is a surrogate for how much he „cares‟ about his situation, combined with an assignment of responsibility that identifies whom he thinks is responsible for his situation. Figure 9 shows how grievance is a function of hardship (relative deprivation) and stance or attitudes. This allows us to avoid the now-discounted theory that deprivation alone leads to violent activity.[29]

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[29] See, for example, Marc Sageman. 2004. Understanding Terror Networks. University of Pennsylvania Press.
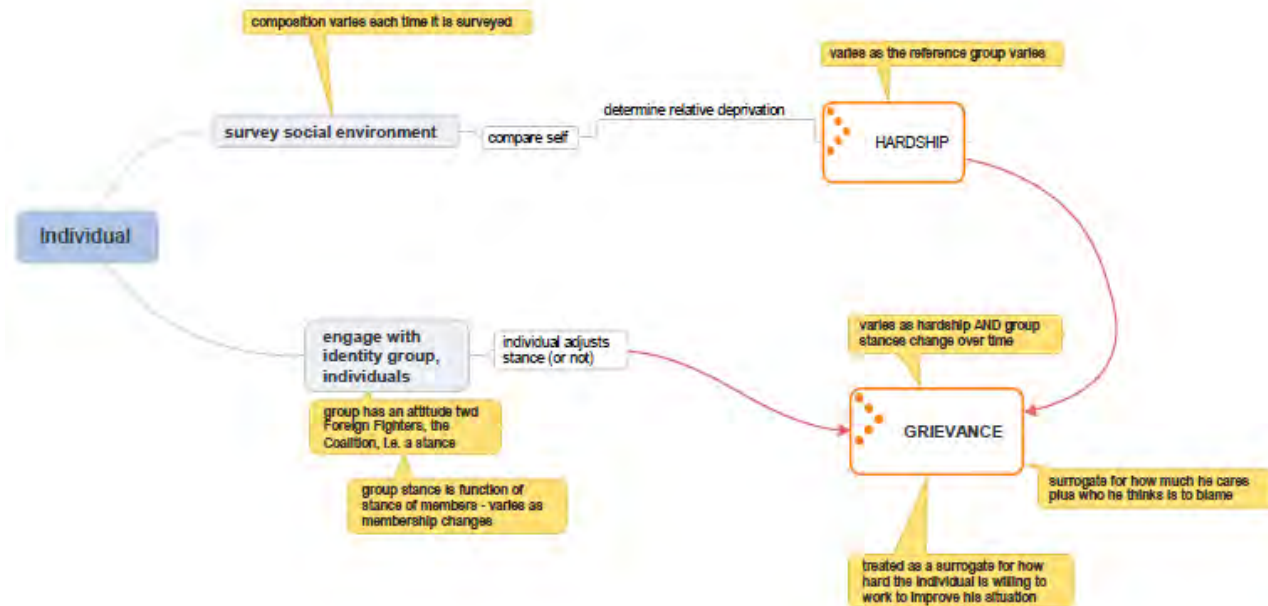
Figure 9: Determining grievance

Risk attitude

An individual actor‟s level of grievance will determine how hard he is willing to work to affect his situation. The types of activities in which he is willing to engage will be determined by his risk attitude (his level of risk aversion).

In our model, all members of the local population are assigned a propensity for risk (a risk attitude, or level of risk aversion) which is unchanging over time. Evidence from the literature now seems to show that most individuals show a concave risk function,[30] that is, they are risk seeking over small stakes and risk avoiding over large.[31]

„Risk aversion‟ is a dimension of a construct addressed in the literature as „risk attitude.‟[32] Risk attitude describes decision making over quantifiable alternatives under conditions of uncertainty. The classic approach to risk attitude evaluates the behavior of an individual when faced with choices between quantified outcomes expressed in terms of probabilities.[33]

Until recently, expected utility theory[34] was the theoretical base for almost all studies of decision making. "Implicit in this theory is the assumption that individuals have stable and coherent

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[30] Barry O‟Neill. 1998. Risk Aversion in International Relations Theory. *Projektbereich B: Discussion Paper No. B-445*. Dec. 1998. P.4

[31] Helga Fehr-Duda, Adrian Bruhin, Thomas F. Epper, and Renate Schubert. 2008. Rationality on the Rise: Why Relative Risk Aversion Increases with Stake Size. Socioeconomic Institute, University o f Zurich. Working Paper No. 0708, February 2008, revised edition.

[32] O‟Neill. Op.cit.

[33] Allison B. Rosen, MD, MPH, Jerry S. Tsai, MS, Stephen M. Downs, MD, MS. 2003. Variations in Risk Attitude Across Race, Gender, and Education. *Medical Decision Making* (Nov-Dec 2003). Pp.511-517. P.511.

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preferences; they know what they want and their preference for a particular option does not depend on the context."[35] Here, "risk attitude is nothing more than a descriptive label for the shape of the utility function presumed to underlie a person's choices."[36]

Expected utility theory is a cognitively based approach to decision making. Affect or feeling enter (if they do at all) only as part of the decision maker's calculation about how he would „feel" about a given outcome. These anticipated emotions thus are incorporated into the determination of value of that outcome.[37]

Under expected utility theory, determination of an individual's risk attitude as risk seeking, risk avoidant, or risk neutral assumes some abstract, objective point of risk neutrality against which such a position can be measured. In 1979, Daniel Kahneman and Amos Tversky introduced a variant on this approach which they called prospect theory. [38] Prospect theory differs from classic expected utility theory in that it requires that the decision maker determine the mid- or risk neutral point of the risk attitude scale. This also allows for variance from individual to individual, but assumes that such a point is determinable and that, once determined, the decision maker will use the same calculus regarding the actual decision as he would under expected utility theory to determine expected value of a given decision. Risk attitudes remain constant for an individual over time as they do with expected utility theory.

The most radical breaks with expected utility theory have come recently in two areas. The first has to do with challenges to the purely cognitive processes that are presumed to drive calculations of expected value (true under prospect theory as well). Evidence from neuroeconomics research is now showing that there is a significant affective component to what had historically been considered a purely cognitive process. [39]

The second departure from expected utility theory is a more global challenge to the nature of the decision itself. In this case, the challenge is to the definition of the decision. In almost all experiments using expected utility theory, the decision itself – the way it was framed and presented to subjects – was treated as an independent variable. The dependent variable was the response, and that response was calibrated as a measurement of risk attitude. Behavioral decision research now suggests that different responses to the same decision are a function of far

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[34] See J. von Neuman and O. Morgenstern 1947 <u>Theory of games and economic behavior</u>, 2nd ed. Princeton, NJ: Princeton University Press
[35] Ted Martin Hedesström. 2006. The psychology of diversification: Novice investors' ability to spread risks. Department of Psychology, Göteborg University, Gothenburg, Sweden P.2
[36] Elke U. Weber, Ann-Renee Blais, and Nancy E. Betz. 2002. A Domain-specific Risk-attitude Scale: Measuring Risk Perceptions and Risk Behaviors. *Journal of Behavioral Decision Making* vol.15. Pp.263-290. P.264.
[37] George F. Loewenstein, Christopher K. Hsee, Elke U. Weber, and Ned Welch. 2001. Risk as Feelings. *Psychological Bulletin*. Vol.127 No.2. Pp.267-286.
[38] Daniel Kahneman and Amos Tversky. 1979. Prospect Theory: An analysis of decision under risk. *Econometrica*. Vo. 47 No.2:263-291
[39] Camerer, Colin F., Loewenstein, George F. and Prelec, Drazen, Neuroeconomics: How Neuroscience Can Inform Economics. *Journal of Economic Literature*, Forthcoming Available at SSRN: http://ssrn.com/abstract=590965 accesses 6/27/08

more complex factors than just risk attitude. Risk attitude thus will become highly time, space, and person-specific.[40]

Expected utility theory (which includes prospect theory) assumes that all individuals will use the same formula to calculate the riskiness of a given decision, and that a given individual"s risk attitude is not decision-dependent. Therefore, it will remain constant from one decision to the next. Individuals, however, do vary in their risk attitude from one another, with the distribution favoring the risk avoidant end of an objectively determined scale. Risk attitude curves for an individual will be concave.

As the type of decisions our actors in the model face are relatively limited and the time frame highly constrained, we feel reasonably comfortable in discounting the constructivist argument for this application. We therefore have randomly assigned each member of the local population a risk attitude, accounting for emotion by the introduction of some randomness. We then skew the assignment curve to represent a population skewed in the direction of risk aversion (see Figure 10).
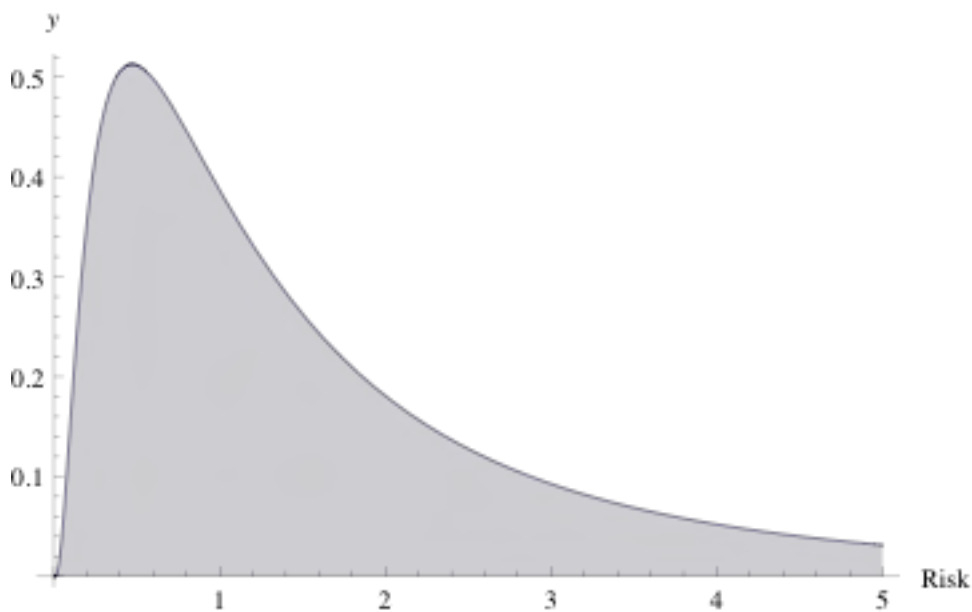
Figure 10: An example skewed distribution. Lower values on the x-axis correspond to higher risk aversion. Most of the "weight" of the distribution is over lower values; thus, a population whose risk aversions are drawn from it will tend to be risk averse.

The local population summarized
During his interaction with other actors in his geographic and social space, a member of the local population acquires information about his environment. He uses this information to determine his condition relative to others. This „condition" has two dimensions. One is his general welfare, which we characterize as „hardship" which is actually determined relatively not

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[40] John W. Payne, James R. Bettman and Eric J. Johnson. Behavioral Decision Research: A Constructive Processing Perspective. <u>Annual Review of Psychology</u>. Vol.43 Pp.87-131. P.91

absolutely. As described earlier, this is determined through an assessment of status homophily. Those with whom a given agent has some level of status homophily become his status group. The other dimension of his condition is his position vis-à-vis various collective actors (e.g. the Foreign Fighters or the Coalition). We call this his stance, parsed as his attitude towards those whom he thinks „are responsible" for his hardship. As this stance reflects values and attitudes, this is determined to a large degree through value homophily. Those with some level of value homophily become the agent"s value group.   The agent"s combination of his perceived hardship and his stance generate his grievance toward various collective actors, expressing the level of activity in which he is willing to engage. His risk attitude tells us in what types of activities he is willing to engage.   An individual with high grievance and high risk aversion may be willing to work very hard to support the Coalition (if he has a pro-Coalition or anti-Foreign Fighter stance), but may not be willing to do it in ways that put himself in significant harm"s way. For example, he might be willing to secretly provide intelligence but not willing to become a policeman. Figure 11 summarizes this progression to action on the part of an individual actor.
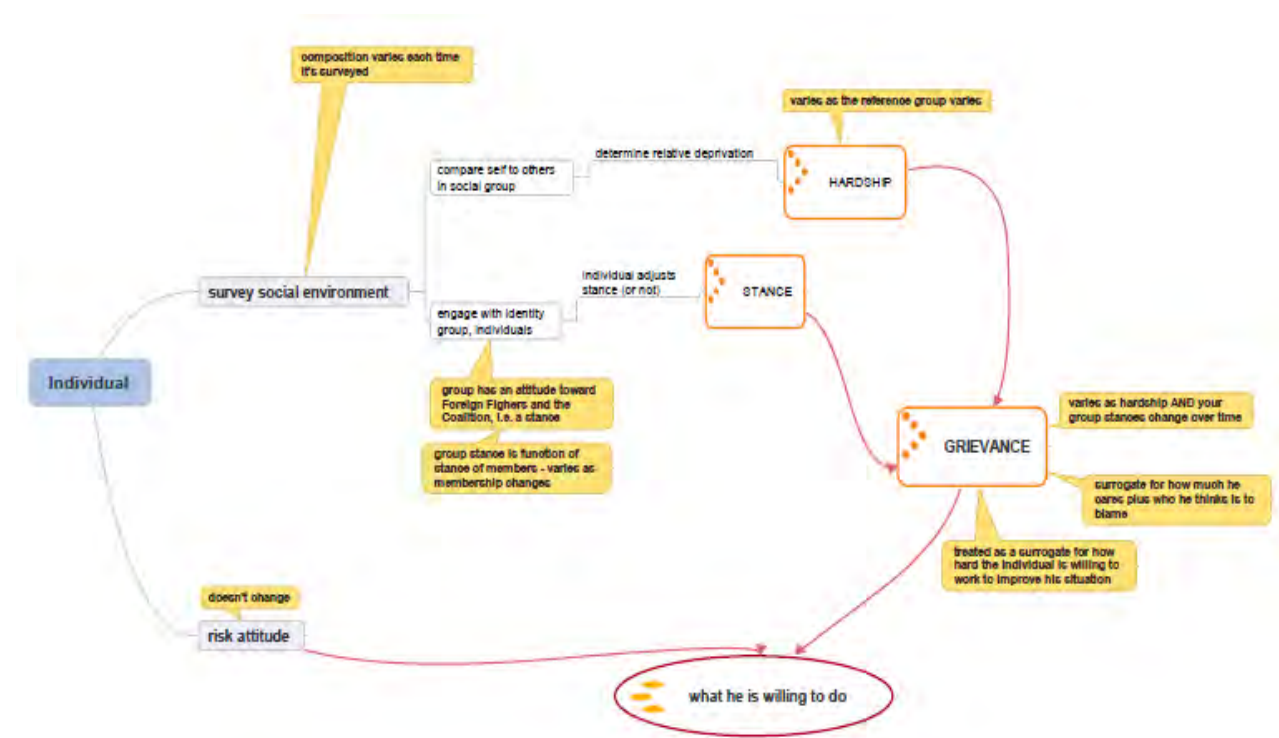

Figure 11: Risk attitude and grievance level

Consequences of social dynamics: emergent groups

As we mentioned earlier in this discussion, members of the local population can hold more than one job at a time, and also can belong to multiple emergent groups. Neither Foreign Fighters nor the Coalition can hold more than one job at a time.

As members of the local population move through geo-social space, they come into contact with one another. (They also come into contact with the Foreign Fighters and the Coalition, of course. We will treat these dynamics in another section.)

We have described these actors, their characteristics, and concepts such as homophily that drive interaction among them. A very important outcome of that interaction is the emergence of social collections which we call emergent groups. These collections may form and dissolve very quickly, creating a shifting yet significant social landscape. Our discussion of emergent groups will show, among other things, how social memory can be important, and how groups which form around key individuals can (not) impact the flow of resources and influence through a population.

Before we get into a discussion of these emergent groups, we need to introduce and define one more aspect of the local population.

Skills

Members of the local population are also distinguished by different capabilities or skills. Planting on a farm, making a bomb, or purchasing food are examples of skills. Each member of the local population is assigned specific skills when he is instantiated. Skills are not explicitly specified, but are represented within the agents with a bit-string (a list of ones and zeros). A one represents the presence of a skill; a zero represents the absence of a skill. The skill set of an agent may change during the course of the run.

What are emergent groups?

Emergent groups are collections of members of the local population. Each collection has a purpose and performs activities that help it fulfill that purpose. For example, an emergent group may have as its purpose to provide security for a neighborhood. Associated activities might be acquiring weapons, shooting at intruders, patrolling, and the like. Each activity requires a certain skill set which are provided to the collection by its members. Each collection reflects the risk attitude and stances of its members, and a member of the local population will join groups that match his grievance and personal risk levels.

Emergent groups have certain behaviors associated with them depending upon their purpose. For example, an insurgent group"s purpose would be to fight the established regime (the Coalition, in our current model). It might perform activities such as building bombs, emplacing bombs, shooting at opposing force, and intimidating citizens. A sewing circle might perform activities such as buying yarn, choosing patterns, meeting at the community center; a horticultural group might engage in buying seeds, digging holes, watering and weeding plants, harvesting, and selling the harvest.

We base our construct on Robert Axtell"s models of firms,[41] where a firm is a group of individuals who are motivated (working) to change the *status quo*. Axtell"s firms are collections

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[41] Axtell, R., (2001). Zipf Distribution of U.S. Firm Sizes. Science, vol. 293, pp. 1818 – 1820. And Axtell, R. (1999). The Emergence of Firms in a Population of Agents: Local Increasing Returns, Unstable Nash Equilibria,

of individuals who work together to create excludable utility (where utility is defined in its most abstract sense).   This utility is distributed equally among the members of the firm. Axtell also assumes that individuals can only join one firm at a time, and that the firm has no life beyond the association of the members with the firm. If all members leave a firm then the firm disappears from the social landscape forever.

While we are using Axtell‟s general approach, we have changed three of his components and assume the following:
1. Actors can join more than one emergent group at a time, where an „emergent group‟ is equivalent to Axtell‟s „firm.‟
2. An emergent group will have a "life" beyond the members – there will be some sort of historical representation or memory of the group.
3. Utility is not necessarily distributed equally among members of an emergent group.

In our model there are three types of emergent groups that members of the local population may choose to join: those where their joining *decreases* the benefit each emergent group member can receive from the group, such as groups exploiting common pool resources like water, grazing land or other agricultural resources; those where an additional member *makes no difference* to the benefit each member receives, as in the case of religious, social or ideological groups; and those where the individual‟s contribution to the emergent group helps *increase* the benefit all other members receive (think of a traditional western economic group or firm, where adding an individual with some unique skill can significantly enhance others‟ productivity). We identify these as emergent groups which exhibit *decreasing* returns to scale, *constant* returns to scale, and *increasing* returns to scale, respectively, see Figure 12.
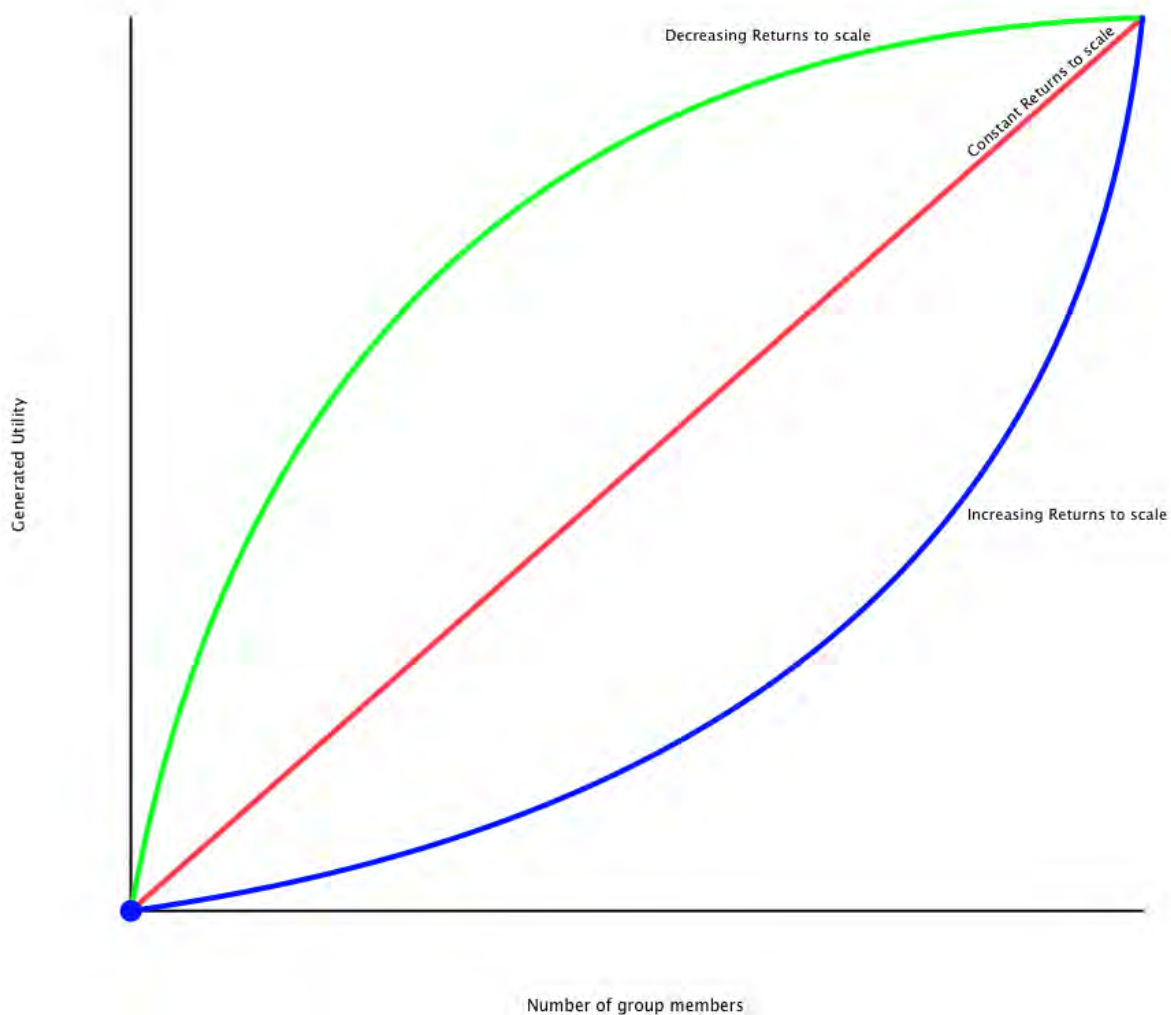
Figure 12: A graph that shows the difference in the relationship between group membership (x-axis) and generated utility (y-axis) constant (red line), decreasing (green line), and increasing (blue line) returns to scale.

How do groups form?

Actors within the local population act to maximize an abstract concept of utility. This utility can come from conventional economic sources or more abstract sources such as religious ideology or political action. We are using joining an emergent group as a proxy for an actor''s decision to increase his utility. Moreover, actors within our model have a "utility metabolism," meaning actors in the model consume utility at a certain rate as time progresses. If the utility held by an actor reaches zero that actor will not "starve" rather, the actions available to that actor will become more limited (e.g., they cannot be a patron (see below) or start an increasing returns group without outside help). Finally, as an actor joins groups in an attempt to increase his utility score, the actor must devote time towards each of the groups he has joined. Time is a scarce commodity that can only be subdivided so much. Actors are able to devote up to 12 hours per

day to "group" activities. Actors must devote at least 8 hours per week to each group to which the actor belongs. This constraint also forces actors to make choices about which groups to join/leave as actors do not have infinite time to devote to various groups.

Members of the local population learn about emergent groups when they interact with their status group and check the emergent group memberships of the members of that status group. An actor then checks the emergent group's risk attitude and grievance and if it is compatible with his own, he will consider joining. (We will discuss later other constraints on that decision.) Since members of the local population do not have perfect information about emergent groups or their (un)successful performance of activities, nor do they possess infinite computing capability, they will often make suboptimal decisions or mistakes and join the „wrong" emergent group, i.e. one that does not match their risk or grievance levels or that does not perfectly maximize their utility. We approximate this by implementing the local population with bounded rationality.[42]

Any member of the local population can serve as the founder of an emergent group. When he does so, the new emergent group reflects his grievance and his risk attitude, as he is the only member. As new members join, their grievance and risk attitude modify the grievance and risk attitude of the group. As a result, over time the older members may leave the group as the grievance and/or risk attitude of the group moves out of their comfort zone.

As an emergent group's risk attitude changes, the group's possible activities also will change although its purpose will not. For example the insurgent's purpose is to counter the established regime (the Coalition). That purpose can be achieved through a variety of behaviors ranging up to violence. How that purpose is achieved by a particular group (i.e. the behaviors in which it engages) may change as the collection of actors who join the group become, in the aggregate, more or less risk averse – but the purpose remains constant. The willingness of a given actor to join a given emergent group or to remain a member (a function of his own risk attitude, among other things) will change accordingly.

New emergent groups can „inherit" characteristics from existing groups. Emergent groups will go „dormant" if they have no members. Dormant groups still exist in the social memory, holding the persona (the risk attitude and grievance) they had at the time they went dormant. They can be revived if actors' grievance and risk attitude match with the dormant emergent group's „remembered" attitudes at some time in the future. This feature allows us to account for the power of history/myth.

Any member of the local population can create one of the first two types of emergent groups (those which exhibit decreasing or constant returns to scale) simply by deciding to do so. Emergent groups that have increasing returns to scale can be created by any actor at any point but require an investment. For a typical economic firm, think of this as the requirement to rent a building for the factory and then pay rent on the building through time. This means that actors who start increasing returns groups must themselves have a positive store of resources, although eventually the emergent group may become self-sufficient and no longer need the inflow of

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[42] Simon, H. (1957). "A Behavioral Model of Rational Choice", Models of Man, Social and Rational: Mathematical Essays on Rational Human Behavior in a Social Setting. Wiley, New York, NY.

resources. This could be interpreted, for example, as a successful investment by the Foreign Fighters or the Coalition in the economic development of the area.

Resources can be provided by either the Foreign Fighters or the Coalition, or they can come from another emergent group or from an individual actor. The resource provider‟s risk attitude and grievance combine with that of the founder to create a persona (risk attitude and grievance) for the group. As the increasing returns emergent group gets larger and as time moves further from the time of founding, the influence of the provider of the initial resources (the resource provider‟s risk attitude and grievance) will wane. Eventually, the emergent group‟s grievance may deviate far enough from whomever initially provided it resources to sever the tie with that resource provider.

We have illustrated the relationships and dependencies that create emergent groups in Figure 13. Figure 13 is read from right to left. An actor ascertains his hardship and his stance, which give him his grievance and so determines how active he wants to be. This, in combination with his risk attitude, gives him a metric with which to evaluate extant emergent groups. He then checks the memberships of others in his status group and maps his grievance and risk attitude to emergent groups to which others in his status group belong. When he joins an emergent group which is within his compatibility parameters, that group‟s collective risk attitude and grievance is adjusted accordingly. When the emergent group‟s collective risk attitude and grievance move outside an individual actor‟s tolerance levels, he will leave the group – leading, of course, to further adjustment of the group‟s grievance and risk attitude. And yes, it is possible that an actor will re-join an emergent group he previously left as it moves back into his „comfort zone.‟ It is movement in the endless social dance.

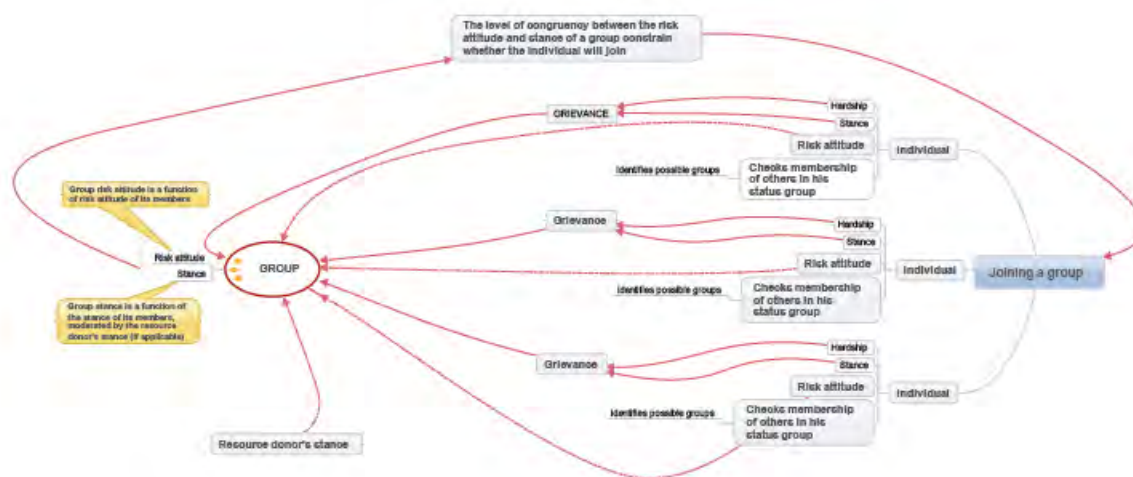Figure 13: Joining a group

How do groups work?
Emergent groups have a purpose which is exercised through activities. Each activity requires a particular set of skills resident within the sum of the group‟s members for the group to be able to

carry out the activity. For example, in order for a group to carry out the activity of planting seeds, somewhere resident in this group must be the capabilities to hold a shovel, walk to the field, dig the right kind of hole, place seeds in the ground, etc. These skills do not need to be known by all members of the group and one member of the group does not need to know all of them. Skills exist within the group in a Hayek-ian sense[43]: if one member of an emergent group has a necessary skill, then the group has that necessary skill. Each activity will require a certain combination of skills: not all skills will be necessary for all activities and not all activities will require the same number of skills. The activities of various types of emergent groups and the skills necessary for each activity are determined *a priori*, as are the skill sets assigned to each member of the local population. A member of the local population will match the skills required by an emergent group to exercise its activities against those he possesses.

As members of an emergent group expend effort in executing their job (performing activities), they generate utility. This utility is then distributed to the members of the group. Agents who bring unique skills to an emergent group enable the group to perform activities in support of its job it otherwise could not. Consequently, these agents are more highly valued by the group than are agents who bring redundant skills, and will receive a larger relative share of the utility the emergent group generates. [44] (Not all skills will be needed by all emergent groups, e.g. a nuclear engineer may have a completely unique skill set in a sewing circle but nuclear engineering is of no value to the sewing circle group. The only skills that „count" here are those that have been determined to be necessary for the activities which comprise the job of the emergent group.) Thus an agent"s share of the utility generated by an emergent group will be adjusted based upon the uniqueness and relevance of that agent"s skill set to the job. Therefore, agents will seek to join emergent groups to which they can make the greatest incremental contribution through the provision of a unique skill relative to the activities which comprise the group"s job.

The activities of an emergent group are ranked by the group according to their risk relative to the set of all of its activities, where risk is defined as the probability of successful completion (see Figure 14.) This risk assignment is dynamic. If, for example, a horticultural emergent group cannot walk to the fields because of an IED detonation (unsuccessful completion of the „walk to the field" activity) the activity will be assigned a higher level of risk in the next time step relative to all other activities the group does which are completed. If an insurgent emergent group detonates a bomb and the detonation is not interdicted, that activity will be assigned a lower level of risk in the next time step relative to other activities of that group which are not completed. Figure 14 shows a graphical depiction of activities and risk for an insurgent group. In making their decision to join or not join an emergent group, members of the local population will take into account the relative risk attitude of the emergent group activities for which their skill sets could be applied. If there is more than one horticultural or insurgent emergent group, for example, this relative risk ranking will affect which of those groups the member of the local population will join.

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[43] Hayek, F. (1945). The Use of Knowledge in Society. The America Economic Review, vol. 35, no. 4, pp. 519-530. And Hayek, F. (1960). The Constitution of Liberty. University of Chicago Press, Chicago IL.
[44] See generally, Johnson, N. (2009). Human group formation in online guilds and offline gangs driven by a common team dynamic. Physical Review E, vol. 79, 066117.
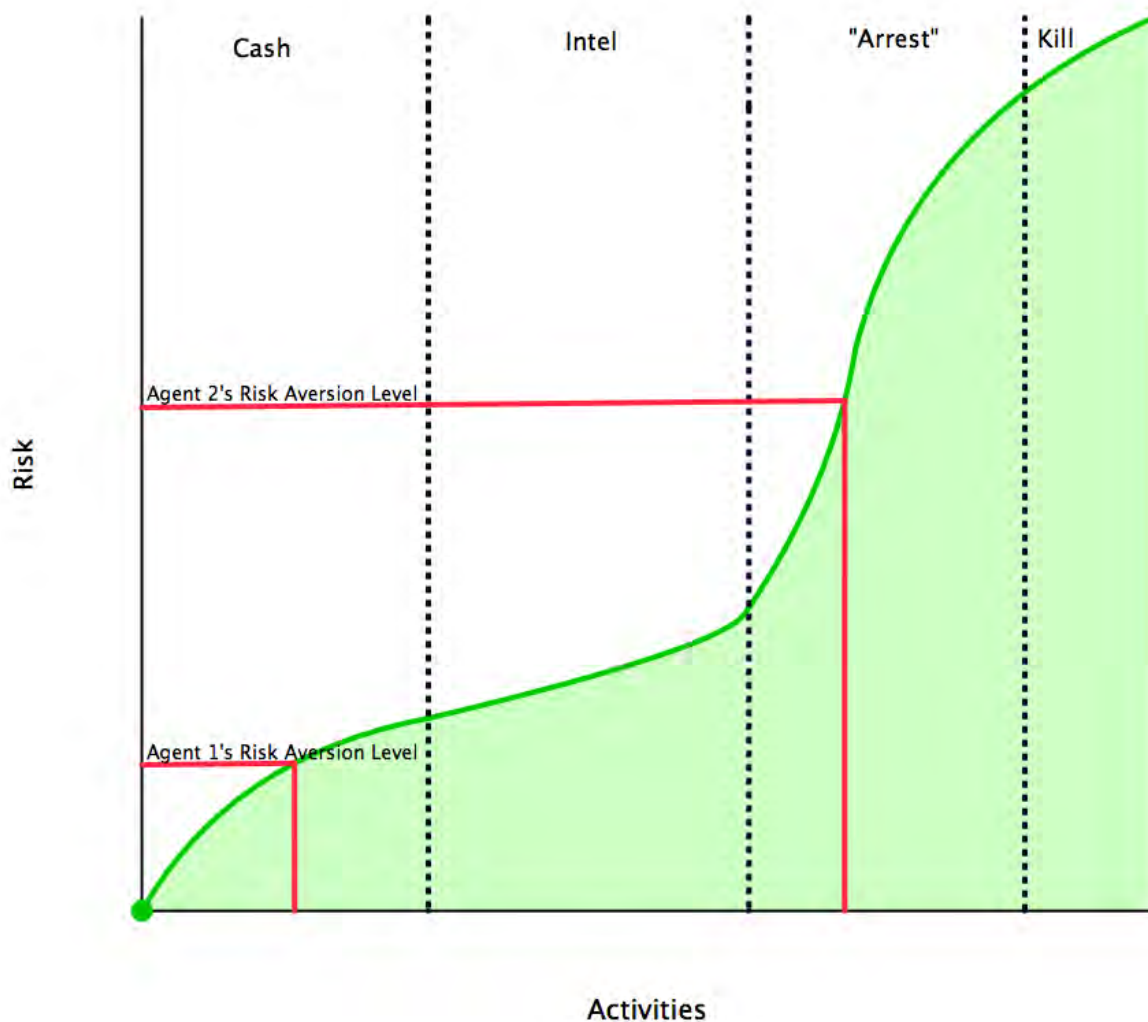
Figure 14: An example of the "risk profile" of an insurgent group at a particular moment in time.

The assessment of this type of risk is made separately from the assessment of the emergent group‟s overall position on risk which is a function of the risk attitude of the group. Recall that an individual actor‟s risk attitude is fixed. An emergent group‟s risk attitude, on the other hand, will change over time as it is a function of the risk attitude of all of the actors who belong to the emergent group at any given point.

Figure 15 illustrates the relationship between the group‟s job, the activities which are required to do that job, and the creation of utility. It shows the relative risk of the activities and how a member of the local population will choose a group to join based upon these factors.
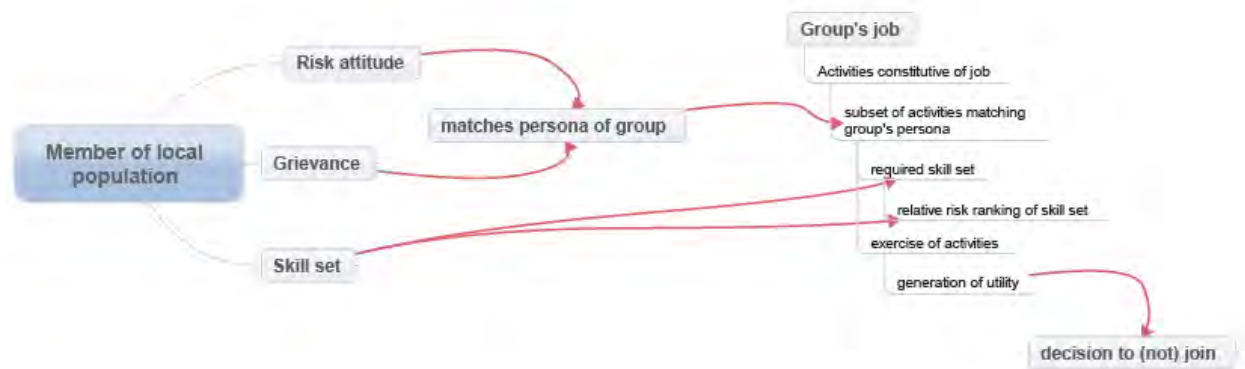
Figure 15: Group activities and skills

Emergent groups – a summary

An emergent group‟s risk attitude and grievance are what attract (repel) prospective members. Members of the local population find out about emergent groups from members of their status group and then join based on compatibility with the group. The individual actor who founds the group is a key factor in determining whether or not the group will survive over its initial growth period.

In an increasing returns emergent group, the founder is also the individual who receives the seed investment. The inclusion of these dynamics, therefore, allows us to explore the impact of the selection of the recipient of resources provided by (e.g.) the Coalition to the local population. *The success or failure of an emergent resources group will be highly dependent on the characteristics of the individual to whom the resources are initially given.* If he is a well-connected individual (in terms of the number of emergent groups to which he belongs) many members of the local population may join these same groups. However, if the founding individual is poorly connected (i.e. does not belong to many emergent groups) and so is not a key individual in the local population, the increasing returns emergent group he founds with the resources may flounder and eventually fail. This highlights the importance of the selection of the recipient of these resources.

We also mentioned earlier that the „social memory‟ function connected with emergent groups in our model can account for the power of history (or myth) in driving behavior. Dormant groups can be revived under a variety of circumstances.

Patron-client relationships

The emergent groups we have just described are groups based on horizontal connections – they are peer-to-peer groups, where a member of the local population makes a decision to (not) join based on interactions with his peers. „Status‟ as we have defined it here is a structural phenomenon, and does not speak at all to power differentials. The principle of homophily says that individuals check for similarities, not differences.

There are, however, other social structures that are based on such differences in power. Of interest to us here is the patron-client relationship.

Patron-client – the theory

Patron-client relationships tend to emerge in social environments in which not all participants have equal access to necessary social resources. These societies are often characterized by significant power differentials usually operationalized as a strong center and a weak periphery. Patrons perform a bridging function between the center and the periphery, obviating the need for those at the center to directly govern those at the periphery.[45] The current situation in the Middle East where power and ties to the outside world are concentrated in central cities like Kabul or Baghdad and with institutions like the Foreign Fighters and the Coalition, is a variant on this construct of differential distribution of power. Thomas Barfield‟s recent "two cheeses" characterization of Afghanistan governance models is an example of how these patron-client relationships could be leveraged.[46] Briefly, he argues that Afghanistan should be thought of as Swiss cheese, not American cheese. In the Swiss cheese model, only some areas (the "cheesy bits") are directly governed. The "holes" are left alone so long as they do not bother the cheesy bits. Theory tells us that patron-client relationships would provide a mechanism for government resources to move from the cheesy bits to the holes with no need to change the social environment in the holes (see Figure 16). David Kilcullen‟s comment on the importance of patron-client relationships in Afghanistan[47] suggests that this is, indeed, what has and may be now happening.

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[45] S.N.Eisenstadt and Louis Roniger. 1980. Patron-Client Relations as a Model of Structuring Social Exchange. Comparative Studies in Society and History. Vol.22. No.1 Pp.42-77, esp. Pp.64ff
[46] Thomas Barfield. 2010. Afghanistan: A cultural and political history. Princeton University Press. Princeton, NJ
[47] David Kilcullen. 2010. Counterinsurgency. Oxford University Press. New York, NY. Pp.183-184

a. "Swiss Cheese," where a central authority does not control all territory within its boundaries.

b. "American Cheese," where a central authority does control all territory within its boundaries.

Figure 16: The Barfield "cheese" theory of territorial governance (Earth imagery from Google Earth).

As we pointed out, patrons are individuals who occupy a bridging function between powerful and outwardly focused organizations and local less powerful individuals. Patron-client relationships, in the sense we mean them here, are characterized by the following characteristics.[48,49,50,51] They are relationships between individuals (not groups) who are inherently unequal. One member of the dyad is always more powerful than the other. These relationships are mechanisms to facilitate exchange, thus they depend upon reciprocity. That said, the value (whether it be represented concretely as „things" or abstractly as money) that flows up the dyad is different from that which flows down. As Karl Jackson put it, "The asymmetric quality of the exchange is expressed in the perception held by leaders and followers alike that a debt in money is seldom repaid in either money or kind. Instead, the obligation incurred is left unstated and unclear, and often, therefore, open ended."[52] The relationships are extra-legal if not illegal. If extra-legal, they are generally ignored rather than sanctioned by the formal legal system. Patron-client relationships often emerge in times of social disturbance, although this is not the only time we see them. "Social chaos generally increases the salience of the informal protective shield offered by patron client…relations."[53] Patron-client relationships are usually entered into voluntarily, although there often is significant social pressure to do so.

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[48] Karl D. Jackson. 1980. Traditional Authority, Islam, and Rebellion: A study of Indonesian political behavior. University of California Press. Berkeley, CA. Pp.188-192.
[49] Eisenstadt and Roniger, op.cit. Pp.49-50
[50] Alex Weingrod. 1968. Patrons, Patronage and Political Parties. Comparative Studies in Society and History. Vol.10. Pp.377-400, esp. Pp.378-380
[51] Domonic A. Bearfield. 2009. What is Patronage? A critical reexamination. Public Administration Review. Vol.69, No.1. Pp.64-76
[52] Jackson, op.cit. P.189
[53] Ibid. P.190

The attributes of a patron-client relationship are illustrated in Figure 17 (many of the specified attributes are discussed more fully below).
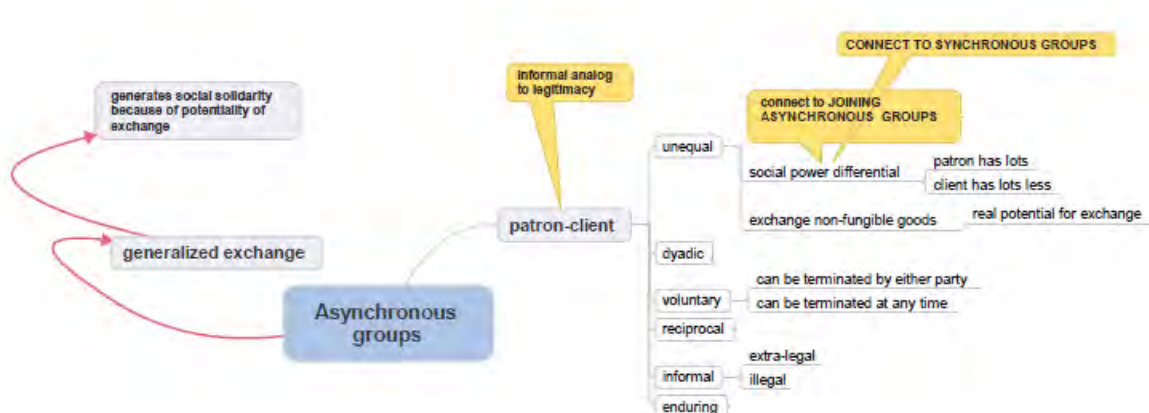

Figure 17: Attributes of patron-client relationship

The asynchronous nature of the exchanges is an important characteristic of the relationship. It is possible that generations will pass before the exchange is completed.[54] This asynchronicity establishes solidarity over time between the receiver and the giver, a solidarity based on trust. Marcel Mauss called this a type of generalized exchange.[55,56] He explained it in terms of gifts (I give you a birthday gift and I have established an obligation on your part to reciprocate at some time in the future) but it applies to many other types of exchanges.[57] In addition to solidarity, this asynchronicity provides an historical depth that is lacking in a transaction-based system.

Patron-client – In action
Patronage networks have the potential to challenge or undermine the strength of horizontal or peer-to-peer relationships as the primary strong connection in a patronage relationship is a vertical one.[58] They thus challenge the salience of status groups and value groups in our model. That said, we believe status and value groups still have relevance and need to be strong players.

Our emergent increasing resources groups lie at the nexus of patronage networks and horizontally defined groups, such as status and value groups and emergent groups. The Foreign Fighters and the Coalition will give resources to an individual. The recipient of these resources serves the patron bridging function between the larger world of the Foreign Fighter and the Coalition and the more circumscribed world of the local population. The resource recipient can then create a patronage network by disbursing the funds. However, once those resources „hit the

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[54] See S.N.Eisenstadt and Lous Roniger. 1980. Patron-Client Relations as a Model of Structuring Social Exchange. Comparative Studies in Society and History. Vol.22. No.1 Pp.42-77. Pp.49-50; Alex Weingrod. 1968. Patrons, Patronage and Political Parties. Comparative Studies in Society and History. Vol.10. Pp.377-400, esp. Pp.378-380.
[55] Marcel Mauss. [1923] 1954. The Gift: Forms and Functions of Exchange in Archaic Societies. Ian Cunnison, trans. With an introduction by E.E.Evans-Pritchard. W.W. Norton & Co. New York, NY.
[56] Eisenstadt and Roniger, op.cit. P.52
[57] Mauss, op.cit.
[58] Jackson, op.cit. P.189.

streets," horizontal ties will draw peers of the clients into the group, creating an emergent group and diluting the strength of the patronage structure.

Of interest to us is the longevity and strength of the patron-client relationship (keeping in mind that the asynchronicity may extend over generations), the nature of the return obligation from the client to the patron, and the tension between the vertical patron-client relationship and the peer-to-peer relationships found in increasing resource emergent groups themselves. Figure 18 illustrates these relationships. For simplicity, we have not included constant and decreasing returns emergent groups in our figure.
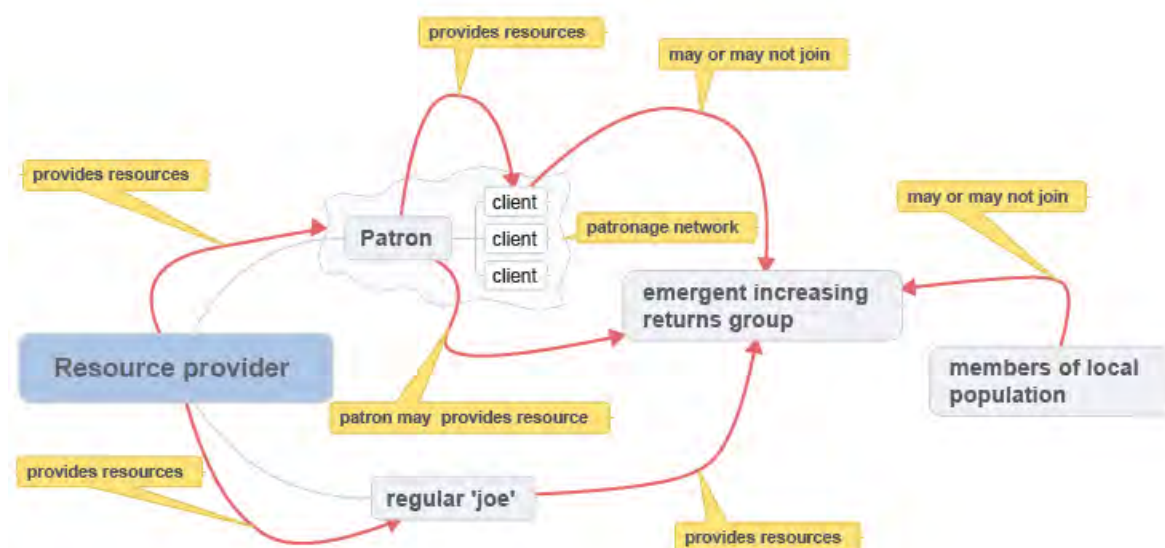
Figure 18: Patrons, clients and emergent increasing returns groups

Keep in mind that a patron can also start a decreasing returns or constant returns group, and that increasing resource groups do not need funds from a patron-figure to start. However, since increasing returns groups require "investment" and since both the Foreign Fighters and the Coalition are seeking ways to intervene to affect the local population, we are focusing here on the relationships between resources and the power structure created by patron-client relationships

Coalition and Foreign Fighters' influence on the local population
Our introduction of the patron-client relationship re-connects us with the Foreign Fighters and the Coalition, both important actors in COIN and in our model space. Recall that IW (and COIN as a particular type of IW) is "a violent struggle for legitimacy and influence over the relevant population."[59] Since, as we shall see shortly, legitimacy is a perception of a regime and not a characteristic of the regime itself, we must consider how the population can be persuaded to adopt this perception. It is not possible to establish a legitimate regime independent of such a

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[59] United States Department of Defense. 2010. op.cit., P.9

perception. And, finally, since the struggle is a violent one, we must consider how all players use kinetic activity to achieve their ends.

We will begin with a discussion of legitimacy and power to establish a clear delineation of the end space of the struggle. We then will discuss two nonviolent methods of impacting a belief space – persuasion and contagion. This section will conclude with a discussion of kinetic activity as it is instantiated in our model.

Legtimacy and Power

In our earlier description of the Foreign Fighters and the Coalition, we said that they could both impose costs and provide benefits. By introducing notions of cost and benefits, we have introduced a notion of power. It is worth taking some time to explore this concept, because power is often confused with legitimacy.[60]

When either the Coalition or the Foreign Fighters take action in the form of costs or benefits, they are exercising power. Power is one mechanism to shape the behavior of others. Power is exercised either by threatening or using coercion to deter or change undesired behavior or by promising rewards to promote desired behavior (i.e. to engender satisfaction).[61] This is an instrumental or conditional means of social control („if I do this, then you will do that")[62] and is a function of the amount of coercion exerted and the benefits provided. It is worth noting that the precise relationship between coercion and reward in terms of stimulating behavior is not addressed in the literature. Most of the literature we have seen addresses only one of the variables (either coercion or reward), so we do not know if their relationship is additive, multiplicative, inversely proportional, or, as is more likely, a far more complicated and nonlinear relationship.

Power which results from the combined exercise of coercion and reward generates compliance with particular authorities (people) or particular directives.[63] It thus is particularistic as it is support for a *specific* action or a *specific* person, not for an institution or a system of government. Compliance can be behaviorally measured as the level of congruity between the action required or requested by an actor (such as a faction) and the actual action taken by the target (i.e. a population agent). We will invoke compliance again in our later discussion of persuasion.

In summary, power is the ability to coerce or provide reward, usually with the goal of ensuring compliance with a request. Compliance is the level of congruity between the request and action. High congruity would equal high power held by the actor issuing the directive.

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[60] Much of the following discussion is taken from Jessica Glicken Turnley. 2008. Legitimacy and Power: An Exploration of Doctrine as it Relates to PSOM. White paper prepared for U.S. Department of Defense, Joint Staff (J8), Warfare Analysis Division. Washington, DC

[61] Tom. R. Tyler. 2006. Psychological Perspectives on Legitimacy and Legitimation. Annual Review of Psychology. Vol.57. Pp.375-400 p.376

[62] Michael Bratton and Robert Mattes. Support for Democracy in Africa: Intrinsic or Instrumental? *British Journal of Political Science* Vol.31, no.3:Pp.447-474. P.448.

[63] M. Stephen Weatherford. 1987. How Does Government Performance Influence Political Support? *Political Behavior.* Vol.9, no.1. Pp.5-28. p.12

Instrumental power of the type we just described is a very expensive means of social control because of the element of coercion.[64] Coercion is socially expensive as it requires the investment in individuals who can continuously monitor behavior and apply either positive or negative pressure to induce compliance whenever necessary. Achieving legitimacy is another way in which regimes can exercise social control in this case without the threat of coercion or the promise of rewards.[65]

There is fairly extensive literature defining legitimacy as a function of procedures that are perceived to be fair, where "fair" is defined by the target population. There are three important elements to this definition. First, it is critical to recognize that legitimacy is the function of a *perception* of a regime, not of characteristics of the regime itself. Second, the „thing" which has legitimacy is a procedure or set of procedures, often embodied in institutions which themselves may be collected into regimes. And third, the focus is on process credibility or fairness. We will treat these in reverse order.

Rule of law is but one way to institute procedural fairness. Max Weber identified two other types of political systems (the traditional, where authority is derived from custom rather than codified law, and the charismatic where authority is derived from the actions or character of an individual).[66] Tom Tyler pointed out the importance of "lay principles of procedural justice," referring to local standards.[67] Most discussions of legitimacy invoke local notions of fairness.

If legitimacy is a function of process credibility (perceived fairness, where fairness is locally defined), it must be established over time. The subject population must see repeated instances of execution of a procedure or process in a fair manner for the regime to establish process credibility. Therefore, unlike power, legitimacy is not event-based but process-based. Initial participation in the procedures may be stimulated through power (coercion or the provision of benefits). However, over time the need for coercion or the provision of benefits as (dis)incentives to participate will decline as the institutions/regime acquire moral authority (legitimacy) and participation is believed to be a moral good in its own right. These relationships are illustrated in Figure 19.

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[64] Tyler. op. cit. p.376

[65] R. Ford and C. Johnson. 1998. The perception of power: dependence and legitimacy in conflict. *Social Psychology Quarterly.* Vol.61. Pp.16-32; JRP French Jr. and BH Raven. 1959. The bases of social power. In Studies in Social Power. D. Cartwright, ed. University of Michigan Institute of Social Research. Ann Arbor, MI. Pp.150-167.

[66] Max Weber. 1947 (c.1900). The Theory of Social and Economic Organization. A.M. Henderson and Talcott Parsons, trans. Talcott Parsons, ed. The Free Press. New York, NY. Pp.328ff
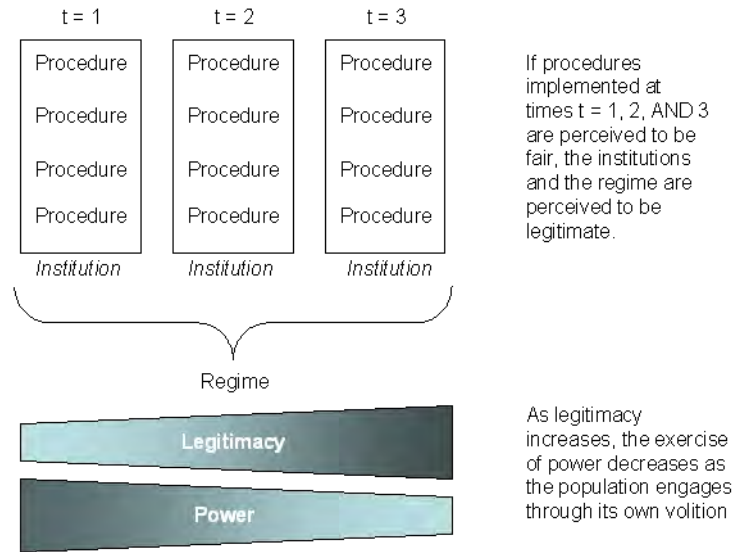
[67] Tyler. op. cit. P.392.

Figure 19: Power and legitimacy[68]

The accepted legitimacy of institutions will allow participants to tolerate certain levels of short-term procedural injustice on the part of individuals without calling the entire system into question.[69] Thus we can tolerate some level of renegade officials as long as we perceive the system itself to be legitimate, for we believe that, over time, the system will punish or otherwise deal with them. Conversely, delivery of additional social goods (i.e. the exercise of power through the bestowing of „rewards") through unfair procedures will not confer legitimacy and therefore will not contribute to stability. [70]

That legitimacy is a function of *perceptions* of a regime (not of the regime itself) may be one of its most important characteristics for this discussion. This moves agency with regard to legitimacy from the regime itself to the population. It is the *population* which bestows legitimacy upon a regime: a regime cannot develop a set of features which would characterize it as legitimate, independent of the attitudes of the local population. [71] Regimes cannot be objectively assessed against one another on some „legitimacy" scale. The presence or absence of corruption, for example, is not an indicator of the legitimacy of a regime. Certain cultures will tolerate more corruption than others and will not see corrupt practices as evidence of unfairness but rather as part of the normal cost of social transactions. However, there is no literature formally addressing that „magic moment" where power is no longer needed because the regime is perceived as legitimate.

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[68] Turnley 2008, op.cit.

[69] KA Hegtvedt and C Johnson. 2000. Justice beyond the individual: a future with legitimation. *Social Psychology Quarterly*. Vol.63. Pp.343-366. p.306

[70].Tyler. op.cit. P.393.

[71] M. Stephen Weatherford. 1992. Measuring Political Legitimacy. *The American Political Science Review*. Vo.86, no.1. Pp.149-166. p.150

Legitimacy involves notions of obligation, i.e. the moral necessity to obey. Control by others is replaced by self-control,[72] which socially is a much cheaper way to ensure social order. Furthermore, if an individual perceives a government as legitimate, he will imbue it with moral authority, that is, he will authorize it to make moral judgments for him (who it is appropriate to incarcerate or kill, for example). This is particularly important in times of crisis or at times when it is difficult to appeal to people strictly on the basis of immediate self-interest. In a society ruled by a legitimate government, people will accept decisions made by institutions of that government, although those decisions may appear to be counter to their own self-interest.[73] This is truly winning the battle for „hearts and minds."

An individual"s perception of the legitimacy of a regime will affect the type of actions he is willing to take towards that regime as it will color his expectations of the regime"s response to him. If, for example, an individual believes a regime is *not* legitimate yet he acts in support of it, there is uncertainty on his part regarding whether or not the regime will reciprocate with a benefit. If he believes a regime *is* legitimate yet he acts against it, he can be pretty certain he will not get benefits from it and there is a high likelihood he will be punished. A matrix showing the relationships among feelings of legitimacy, actions and benefits and punishments is shown in Table 2.

Table 2: Feelings of legitimacy, actions and consequences

Impact on an individual's feelings of Legitimacy of a regime			
Individual		Action from Regime X	
Individual"s Current Feeling of Regime X"s legitimacy	Individual"s Current Action* towards Regime X	Benefit towards Individual	Punishment towards Individual
Legitimate	Pro	++	-
Legitimate	Against	-	+
Not Legitimate	Pro	+	--
Not Legitimate	Against	-	0
Neutral	Pro	+	-
Neutral	Against	-	+
Legtimate/Neutral/Not Legitimate	Neutral	0	0

*Action: the behavior that the agent is currently exhibiting towards the regime at time that the regime is imparting either a benefit or a punishment.

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[72] Erich Weede. 1996. Legitimacy, Democracy and Comparative Economic Growth Reconsidered. *European Sociological Review*. Vol.12, no.3. Pp. 217-225 Pp.217-218; also, Tyler, op.cit. P.378
[73] There has been some interesting work done here on courts of law and unpopular decisions, including work in emerging democracies (S. Machura. 2003. Fairness, justice, and legitimacy: experiences of people"s judges in South Russia. *Law and Politics* vol.25. Pp.123-150) and the Bush v. Gore US Supreme Court decision of 2000 (JL Gibson, GA Caldiera and LK Spence. 2003. The Supreme Court and the US Presidential election of 2000: wounds, self-inflicted or otherwise? *British Journal of Political Science*. Vol.33. Pp.535-556.).

Recall that legitimacy involves notions of the moral obligation to obey. Earlier we introduced an informal power structure constructed around the patron-client relationship. We emphasized that this relationship is generally extra- if not illegal, yet carries strong social sanctions in instances of violation. We also pointed out that the asynchronicity imbues the relationship with historical depth that allows for the assessment of the process over time. In this way, a patron-client network (patrons with their several clients) is perceived to have „legitimacy" in many of the same ways as a governmental structure. As such, it should not be ignored in a COIN context.

Thus if our end game in COIN is legitimacy and influence over the relevant population, we must work to change the perceptions the population holds. Changing the regime may be necessary but is not sufficient. This brings the discussion back to the local population.

Belief space

Incorporation of mechanisms for changing attitudes (what we have called stances – the assignment of responsibility for one"s [lack of] hardship) is critical to the implementation of the COIN model. We will present two different approaches to this problem, and then describe how we incorporated them both into the COIN model.

One approach focuses on developing and exercising a model of contagion, which belongs to the family of models known as epidemiological models. The other is what is often called a „social learning" or probit model which is of the same family as approaches explored in the persuasion literature.

The two approaches are used to answer very different types of questions, are based on assumptions of a different type, and provide significantly different learning outputs. Exploration of leverage points either to stimulate or retard diffusion of something through a population generally utilize computationally generated contagion models. Hence these models are frequently found in the marketing literature. Efforts to understand how a process works usually employ social learning models often (but not always) elaborated discursively (and/or mathematically) rather than computationally. Social learning models predominate in the economics literature, and, not surprisingly, are generally based in notions of rational decision-making[74] in which decision-makers weigh the innovation"s benefits before adopting[75] or are subject some other social pressures that influence adoption. Persuasion introduces the affective dimension into the rational calculations of social learning approaches. Since we are asking both types of questions in our model, we have chosen to include both.

We will explicate these two approaches below. We will then describe our approach which combines the two.

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[74] Simon, H.A. (1960), The New Science of Management Decisions, Harper & Row, New York.
[75] Young, H. Peyton, The Spread of Innovations by Social Learning, John"s Hopkins University, 2006

Persuasion

We will start with the persuasion or social learning approach. Persuasion refers to "any procedure with the potential to change someone"s mind."[76] Persuasion research does not analytically distinguish between changes in attitudes or beliefs, although most of the research speaks of attitudes. Attitudes (to summarize decades of definitional debate) are defined as "an evaluative integration of cognitions and affects experienced in relation to an object."[77] That is, an attitude is a value judgment about something (which can be tangible or intangible) with the judgment informed by some intersection of thought and emotion. The target of the persuasive act in the COIN model is the stance, the expression by an individual of whether or not he holds some particular group responsible for his condition, (be it good or bad), i.e. his attitude towards some particular group.

A persuasive act involves a persuader or a source, a message, and a receiver. The source has received the least attention in the persuasion literature. The receiver, on the other hand, is the subject of most of the persuasion literature, for he is the locus of the ,persuasion event" and is the element which is most active in the process of persuasion. Messages are generally treated as neutral: they are not inherently more or less persuasive from the standpoint of pure content (if there can be such a thing as pure content). Their persuasiveness is dependent to some large degree upon the relationship of the receiver to the source and to certain aspects of the message such as packaging. Most current analytic approaches use a dual-process model, also called an elaboration likelihood model,[78] in which the receiver subjects the source and the message to separate analytic processes.[79]

There are different methods of persuasion. In *internalization*, the receiver focuses primarily on the message. Here, the individual changes his position because he believes the idea itself has merit or "is congruent with his value system." In *identification*, an individual changes his attitude because he wants acceptance from the sender. Here the receiver focuses primarily on the sender. The change is attitudinal, which may be *expressed* through behavior, but which is not that behavior. *Compliance*, in which the receiver conforms behaviorally but does not change his attitude, may be called a third form of persuasion,[80] in which elements of power-based coercion may be at play. From a behavioral standpoint, compliance, internalization and identification look identical. However, what is needed to induce that behavior is different in each case.

Homophily, particularly value homophily, matters in two of the three types of persuasion. As we noted above, in a compliance scenario, the receiver does not change his attitudes but "go[es] along with the accepted norms in order to avoid social ostracism or perhaps even

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[76] Petty, R.E. (2007) Persuasion: From Single to Multiple to Meta-Cognitive Processes *Perspectives on Psychological Science* (Ohio State University: Columbus Ohio, 2007), p3

[77] Crano, W. D. and Prislin, R. (2006). Attitudes and Persuasion. *Annual Review of Psychology*, 2006, vol57:345-374; p.347

[78] Petty, R. E., Cacioppo, J. T., & Goldman, R. (1981). Personal involvement as a determinant of argument-based persuasion. *Journal of Personality and Social Psychology, 41,* 847-855.

[79] Crano, W. D. and Prislin, R. (2006). Attitudes and Persuasion. *Annual Review of Psychology*, 2006, vol57:345-374; p.348

[80] Kelman, H. C. (1958). Compliance, identification, and internalization: Three processes of attitude change. *Journal of Conflict Resolution* vol 2, no,1:51-60

persecution."[81,82] In this case, the receiver changes his behavior to that which looks more like the sender (or sending community) to avoid punishment. In the case of identification, the receiver also tries to become more like the sender but in this case it is to receive a benefit, not avoid punishment. It is only in internalization, in which the focus of the receiver is on the message, that homophily generally does not come into play.

Identification in particular depends upon the receiver perceiving some initial identification or homophilitic connection between himself and the sender which makes him feel comfortable with the sender and so „willing" to engage. Locke notes that "numerous studies found that shared attitudes typically invoke positive feelings and facilitate interpersonal attraction…people find it more comforting to share experiences with others who are experiencing similar apprehensions…, moods…, or problems…"[83]

Affect plays a large role in persuasion. A sender and receiver will converge on the affective dimension over time. That is, given that some degree of value homophily exists (recall that value homophily incorporates an affective dimension), a sender and a receiver in our model will have the same stances – they will both be pro-Coalition, for example – although they may hold those attitudes and values with different strengths. Over time, they will become more like each other in their attitudes with movement toward the attitude that is held most strongly,[84] i.e. they will move away from the midpoint towards the ends of a scale. In our model, then, we assume that two individuals engaging on an affective basis (i.e. with high value homophily) will converge in values and attitudes (their stances) to the average plus some value in favor of the more extreme individual.

When two individuals with contrasting attitudes meet, the most likely scenario (according to the principles of homophily) is that there will be no relationship. Individuals with contrasting attitudes will repel each other rather than exhibit a neutral force.[85,86] The probability of a relationship forming decreases as the distance between the values and attitudes of the two agents (represented in our model as their stances) increases.

Conversely, the probability that they will engage increases as the values converge. In a special case, if the agents' signs are different (e.g. if one is pro-Coalition and the other anti-Coalition), the principle that the smaller the difference between their values (i.e. the closer to neutral they both are) the greater the probability of a relationship forming still holds. However, even with the smallest difference in value, the difference in sign means that the probability of their forming a relationship is small. Recall here our earlier discussion about value homophily where we argued

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[81] *Ibid.*, p.59

[82] Wood, W. (2000). Attitude Change: Persuasion and Social Influence. . *Annual Review of Psychology vol51:539-570*

[83] Locke, KD 2003 "Status and solidarity in social comparison: agentic and communal values and vertical and horizontal directions" Journal of Personality and Social Psychology 2003:84 (3):619-631. P.620

[84] Anderson, C, Keltner, D, John, OP 2003 "Emotional convergence between people over time" Journal of Personality and Social Psychology 2003:84(5):1054-1068. P.1054

[85] Ibid.,

[86] Locke, KD and Horowitz, LM 1990 "Satisfaction in interpersonal interactions as a function of similarity in level of dysphoria" Journal of Personality and Social Psychology 1990:58(5):823-831

that if there is no value homophily, actors may disregard that dimension altogether and engage strictly on the basis of the initial status homopholitic connection. If the two agents with different signs do form a relationship, over time (relatively quickly) the positive sign will become negative, and the affective values of the two agents will begin to converge, again in favor of the agent with the greatest negative affective value. [87,88] In concrete terms, this means that if agents with a pro- and anti- stance do engage, the pair is likely to converge toward the anti- end of the scale. Figure 20 shows a graphical depiction of these dynamics.
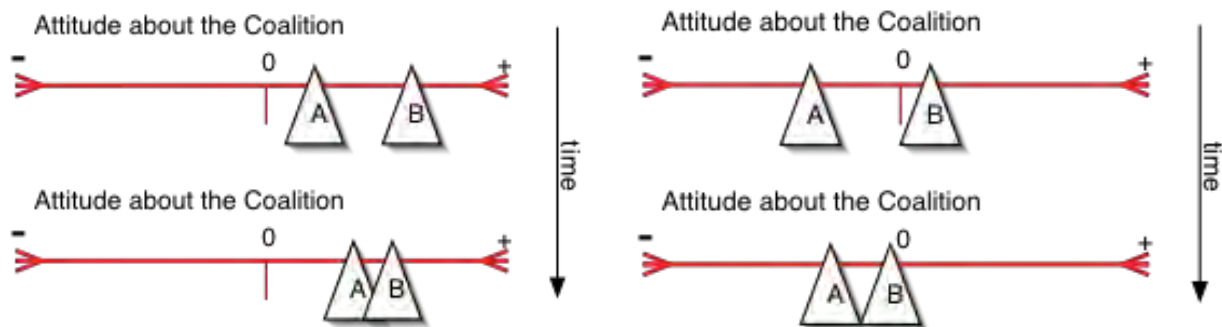
a. Change when both are on the same side.   b. Likely change when on opposite sides.

Figure 20: The dynamics of stance change given some sort of homophilitic connection.

Changes in attitudes and values that arise from internalization will be longer lasting than changes resulting from identification. If change in attitude results from identification with the message source, that is, a perception of high homophily, close proximity to or frequent reminders of the source are necessary to maintain the new attitude. If the attitude change is based primarily on consideration of aspects of the message, the change in the receiver will persist in absence of the source. However, if the receiver is neither motivated to nor cognitively capable of evaluating the message, or if his cognitive evaluation results in a neutral outcome, he will assess his level of affinity for the sender, calculated as some measure of homophily and affective bias towards environmental cues (e.g. he does not like people with beards). A high level of affinity will lead to identification or compliance.

We explored the notion that certain individuals may be more „persuasive‟ or charismatic than others and so draw receivers more strongly than the general population. However, we discovered that charisma is not a characteristic of a person, but of a relationship.[89] Charismatic relationships are characterized by senders who score high on certain personality characteristics such as the need for power and low on the need for affiliation, and receivers who score conversely (low on the need for power and high on the need for affiliation). If we are interested

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[87] Strack, S and Coyne, JC 1983 "Social confirmation of dysphoria: shared and private reactions to depression" Journal of Personality and Social Psychology 44:798-806

[88] Gotlieb, IH and Robinson, LA 1982 "Responses to depressed individuals: discrepancies between self-report and observer-related behavior" Journal of Abnormal Psychology 91:231-240

[89] see House, R.J. (1991) Personality and charisma in the U.S. presidency: a psychological theory of leader effectiveness. *Administrative Science Quarterly* (Sep 91) for references to over 20 empirical studies on charisma

in persuasion through identification, we would be interested in receivers who have high needs for affiliation, and in senders who are able to establish common bonds with receivers by identifying characteristics the sender has in common with the receiver, adopting similar mannerisms or speaking styles, or the like – in short, who can recognize and exploit homophilitic relationships.

Since we do not include a psychological dimension in the COIN model, we have randomly assigned all members of the general population an „impressionability" parameter. Those with the lowest impressionability factor will never change their attitude while those at the other end of the spectrum will have the capability of flipping to the opposite end, i.e. those who were pro-Coalition could now become equally violently anti-Coalition. We realize that this will limit the utility of our model in some areas, as we cannot identify particular individuals who will be more effective at delivering a given message than others, although we also may have been able to account for some of this behavior through our introduction of the patron-client dyad. However, this model was intended to serve as an operational or strategic not tactical decision support tool, so we believe this limitation is acceptable.

So persuasion can help us understand how the nature of the relationship between the sender and the receiver affects the likelihood of message adoption occurring. Persuasion focuses on the probability of an actor engaging with another and the consequences of that engagement. It is a bottoms-up approach, focusing on the process of creating a connection, among other things. This requires that the actors be heterogeneous so the degree of likeness will vary across engagements. Note also that the „decision" to identify is one the receiver takes. If acceptance of a message occurs simply because of contact, that is a function of structure, not of agency on the part of the actor. This is the locus of the philosophical differences of the diffusion or contagion-based, and persuasion approaches.

Movement of things through a population
Epidemiological or contagion models generally posit a set of homogeneous agents who are connected by some known structure (a network). Agents can differ only in the value assigned to susceptibility parameters. The susceptibility parameters will determine whether or not the agent becomes „infected" when it contacts another agent who is already infected. Any change in the intensity of the „disease" along any of susceptibility parameters is exogenously introduced in an epidemiological model. We will go into more detail on the structure of these models later, but note that most contagion models do not allow for partial infection. One is either infected or not. While this may be an effective heuristic in biological instances of contagion, it is problematic when we move into the realm of social contagion, particularly the diffusion of ideas or beliefs. One can be „leaning towards" an idea, partially convinced, etc. – all useful concepts in an information operations campaign.

Assumptions about contagion and associated contagion models tell us something very different about messages than persuasion. Contagion *assumes* a structure in the form of a network (although some of the models might derive a structure from data and certainly most analyze that structure). The networks are representations of cumulative data – they present the data all at once. Sequentiality and causality (why one node joined with another) are not askable questions. For this reason also, social networks in the contagion literature „declare" homophily between

connected nodes (although much analytic effort is expended on exploring the nature of this homophily). Homophily is a characteristic of a connection, not a driver for the nodes to connect. Contagion approaches are top-down, describing movement not cause for movement.

The contagion metaphor has been extensively and directly applied to the social problem of the movement of innovations through populations, a problem space known as the „diffusion of innovation.‟ This problem space often includes applications to the diffusion of ideas. This area is of particular interest to us if we are concerned with understanding the success or failure of policy or ideological interventions.

The diffusion of innovation became a popular problem space in the middle of the twentieth century. As such, much of the early work was done discursively as it prefigured the advances in computational science and technology that allowed leaps in the development of social network theory and analysis. Since those developments in the computational world have taken place, much work in the diffusion of technology and ideas has migrated to computational media, using terminology very similar to contagion models.

Theoretical development in the diffusion of innovation has been strongly limited by the socio-cultural and technical context of its origins. Exploration of the diffusion of innovation became popular in a time of economic expansion and national boosterism in the United States, and a time of celebration of entrepreneurship and innovation. As such, there is much research on why innovations succeed in disseminating, but very little on why they fail.[90,91] This is still the case in the field of (social) contagion.[92] Perhaps because of its discursive early years, the field does exhibit characteristics that make it sort of a hybrid between a strict contagion approach and a persuasion or social learning perspective.

Everett Rogers, one of the early scholars who popularized studies of the diffusion of innovation, did pick up on Lazarsfeld and Merton‟s principles of homophily – but he focused on their associated notion of heterophily, an assessment of difference rather than similarity.[93] Rogers argued that diffusion requires a certain degree of heterophily, for the higher the degree of homophily, the less social space for new ideas.[94] Rogers thus prefigured the notion of the strength of weak ties, which has used data-based network analysis to support this point.[95],[96] However, whether he used homophily or heterophily, he was forced to differentiate his actors to be able to generate an adoption S-curve. He did so, dividing them into the now iconic categories

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[90] Greenhalgh, Trish, Gleen Robert, Paul Bate. 2004. How to Spread Good Ideas: A systematic review of the literature on diffusion, dissemination and sustainability of innovations in health service delivery and organization. Report for the National Co-ordinating Centre for NHS Service Delivery and Organisation R&D (NCCSDO). http://www.sdo.nihr.ac.uk/files/project/38-final-report.pdf accessed June 2010

[91] Jason MacVaugh and Francesco Schiavone. 2010. Limits to the diffusion of innovation: a literature review and integrative model. European Journal of Innovation Management. VOl. 13.No.2. pp.197-221

[92] Personal conversation with P.S. Dodds. June 2010

[93] Lazarsfeld and Merton, op.cit.

[94] Rogers, Everett M. [1962] 1983. *Diffusion of Innovations*. New York: Free Press. P.19

[95] Mark S. Granovetter. 1973. The Strength of Weak Ties. American Journal of Sociology. Vol.78, No.6. Pp.1360-1380

[96] Axelrod, R. (1997), The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration, Princeton University Press, Princeton

of innovators, early adopters, early majority, late majority, and laggards with associated sociological explanations of the categories.[97] Most diffusion of innovation literature follows this dictate to differentiate actors in some way that identifies influences on the probability of adoption,[98] although the specific categories used may be different from Rogers". Actors in these models thus are different in kind, unlike the contagion literature based on random networks which differentiates actors by changes in value along a single dimension, i.e. a susceptibility threshold. This makes these types of diffusion models much more applicable to our approach to COIN than classic contagion models.

In her review of different models or theoretical approaches to the diffusion of innovation, Wejnert identifies six sets of variables that the literature describes as influencing the probability of adoption: what she calls the "societal entity" of the actor, which really means the level of granularity of the analysis (is the focus on individuals, for example, or firms or countries?); familiarity with the innovation; status characteristics; socioeconomic characteristics; position in social networks (we will return to this later for it is of great interest to scholars of social contagion as well); and personal characteristics.[99]

If we map these variables onto our COIN model, we find that we have accommodated them all. Our social entities are socio-cultural classes (the identities we discussed early on, defined by the intersection of the values assigned to the set of attributes for a particular actor). We cannot handle (un)familiarity with an idea, but could use as a surrogate the relative value homophily of a receiver actor with the sender actor, arguing that the stronger the value homophily the more likely they are to have the „same" beliefs and attitudes.[100] As we illustrated above in our discussion on persuasion, this will color the receiver"s willingness to engage. Status and socioeconomic characteristics we capture through status attributes that are used to develop social groups and which have been treated recently in the literature under the rubric of structural homophily.[101] And finally, we do capture high-level personal characteristics in our attribute set, but do not address personal psychological predilections by virtue of the social entity we use (socio-cultural classes of actors). We thus account for all of the variables identified by the diffusion literature as influencing the probability of adoption. This underscores the applicability of a diffusion approach to helping us understand the spread of the types of ideological interventions that can affect the development of legitimacy in a COIN environment.

Marrying diffusion and persuasion
Social learning or persuasion-based models can tell us about individual adapters and how a particular intervention may be received. However, they are much more difficult than epidemiological constructs to model computationally. Clark, for example, identifies a decision making process involving five stages in a hybrid persuasion-diffusion model: knowledge or

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[97] Rogers, op.cit. P.150
[98] Wejnert, Barbara. 2002. Integrating Models of Diffusion of Innovations: A Conceptual Framework. Annual Review of Sociology. Pp.297-326. Pp.302-310
[99] Ibid.
[100] We recognize that beliefs and attitudes are not quite the same as ideas, as one is affective and the other cognitive. But it is close enough at the level of abstraction at which we are working here to be used for illustrative purposes.
[101] Burt reference from Sarah paper

exposure to an idea and understanding its functions; persuasion or formation of a favorable attitude; decision or commitment to its adoption; implementation (putting it to use); and confirmation or reinforcement based on positive outcomes.[102] Furthermore, actor heterogeneity is key to a social learning model. Furthermore, actors may display different adoption patterns for different kinds of ideas. Although some contagion models now are incorporating this feature,[103] most do not.

Heterogeneity in social learning models is represented as variability in beliefs[104,105] which look quite like susceptibility parameters. However, as agents acquire „experience" with the target, the character of the agent as defined by these beliefs changes. As an agent interacts with others who have some knowledge about the target, his own beliefs are updated as a consequence. As Young points out learning "is a more complex process than contagion because it involves two separate effects: as more people adopt, more information accumulates that helps persuade the remaining people to adopt; in addition, however, the remaining people are inherently more pessimistic and hence harder to persuade." [106] This has been called an „information cascade," i.e. when some critical mass of an agent"s associates adopt, an agent will adopt irrespective of the value of his susceptibility parameters. It has also been called an adoption threshold, where the threshold is the minimum proportion of adopters in the agent"s reference group that induces him to adopt also. [107,108,109,110,111,112]In this way, the stimulus for agent change is *endogenous* to the model in social learning models (as the agent comes in contact with those who have already adopted, his own likelihood of adopting will be adjusted), unlike contagion models where the „infection" is exogenously introduced.

As we have mentioned several times, persuasion or social learning approaches and diffusion or contagion approaches tell us very different things about the dynamics that exist between messages and populations. Persuasion tells us how and why a particular individual (or type of individual) will adopt an idea held by others (be persuaded). It is message-neutral in approach, asserting that whether or not a message is adopted has to do with characteristics of the sender

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[102] Clarke, R. (1999), „A primer in diffusion of innovations theory", Xamax Consultancy Pty Ltd, Canberra,

[103] See, for example, Peter S. Dodds and Duncan J. Watts. 2005. A generalized model of social and biological contagion. Journal of Theoretical Biology 232. Pp.587–604

[104] Jensen, Richard (1982), "Adoption and diffusion of an innovation of uncertain profitability," Journal of Economic Theory, 27, 182-193.

[105] Jensen, Richard (1983), "Innovation adoption and diffusion when there are competing innovations," Journal of Economic Theory, 29, 161-171.

[106] Young, op.cit. P.3-4

[107] Ryan, B. and N. Gross (1943), "The diffusion of hybrid seed corn in two Iowa communities," Rural Sociology 8, 15-24.

[108] Coleman, James S., Elihu Katz, and H. Menzel (1966). Medical Innovation: A Diffusion Study. New York: Bobbs Merrill.

[109] Granovetter, Michael S., and Roland Soong (1983), "Threshold models of diffusion and collective behavior," Journal of Mathematical Sociology, 9, 165-179.

[110] Macy, Michael (1991), "Chains of cooperation: threshold effects in collective action," American Sociological Review, 56, 730-747.

[111] Valente, Thomas W. (1996), "Social network thresholds in the diffusion of innovations," Social Networks 18, 69-89.

[112] Valente, Thomas W. (2005), "Network models and methods for studying the diffusion of innovations," in Peter J. Carrington, John Scott, and Stanley

and receiver, not with characteristics of the message. Contagion, on the other hand, focuses on the message and its movement across a population. It attempts to develop algorithms that describe that movement. Diffusion is a version of a contagion approach that attempts to take agent heterogeneity into account, to handle the structured (non-random) nature of networks found in social organizations.

As a weak analogy, think of the differences between micro- and macroeconomics. Microeconomics is interested in the individual firm or individual actor and the decisions that the firm or actor makes (actions they take) relative to the allocation of resources and the prices of goods and services. This aggregates to discussions of supply and demand and similar principles. Macroeconomics, on the other hand, is interested in characterizing the collectivity. It is concerned with economy-wide phenomena such as gross national product, unemployment, economic growth rates and the like. While in theory macroeconomics reflects aggregated behaviors which are explained by microeconomics, analytically theory has not yet advanced to a place where the two approaches can be substantively integrated. Such is the case for persuasion and diffusion approaches to the dynamics of the interactions between messages and populations.

Given this relationship between the two approaches, we will use persuasion and computationally encoded rules derived from it to capture these message-population dynamics in the COIN model. We will then model the same population and the same message using a diffusion-based approach. Our supposition is that if we find some loose degree of fit between the results generated by the two different approaches, the decision rules we created for the actors are reasonable.

Kinetic activity

We have spent a great deal of time discussing how we have constructed the social space in our model. As our challenge problem is focuses on the *computational representation of the interdependence between kinetic and non-kinetic aspects of a battlespace,* we now introduce the kinetic dimension.

Our primary actors in the kinetic domain are the Foreign Fighters and the Coalition. The local population engages as one of the targets of the kinetic actions, and as a participant through the insurgent job and the provision of HUMINT.

Foreign Fighters have an attractive side, as the Coalition has a negative side. Foreign Fighters (acting in what we have called an „advocate‟ job) can provide benefits (such as medical care, status or food) to individuals in the local population. Foreign Fighters (acting as a collectivity) can provide resources (a differently named benefit) to other groups (think here of madrassah schools or security for a village) or to individuals. Foreign Fighter advocates also will kill or kidnap Coalition members or members of the local population. As with the Foreign Fighter advocates, Coalition advocates also provide benefits to individuals in the local population (think of civil affairs actions, and the provision of medical care, etc), and (acting as a group) provide resources to other groups (schools, for example) as well as to individuals. Coalition advocates can also impose costs through killing and arresting Foreign Fighters and local population members.

The violent activities we have incorporated in our model are limited and center around the detonation of IEDs and the use of direct fire weapons. We have parsed the IED process to include bomb-makers and bombers. Foreign Fighters can make IEDs, store them in caches, retrieve them, emplace them and detonate them. (Our model assumes that the IED ‚supply chain" is successful, and the bomb-makers have all the materials they need.) Members of the local population who join the job group „insurgents" also can choose to become bombers if their level of risk aversion is low enough. If their risk aversion is high but their anti-Coalition stance is strong, members of the local population can engage in intelligence gathering activities for the Foreign Fighters and insurgents (RED HUMINT) instead of becoming bombers.

The IEDs are emplaced along routes traveled by the Coalition.   Members of the Coalition patrol, or travel in convoys, both of which are vulnerable to IEDs. They also perform operations to find and defuse IEDs.

These actions are all illustrated in Figure 21. A box marked with an „A" describes an action. A box marked with an „I" is a group that can take an action.
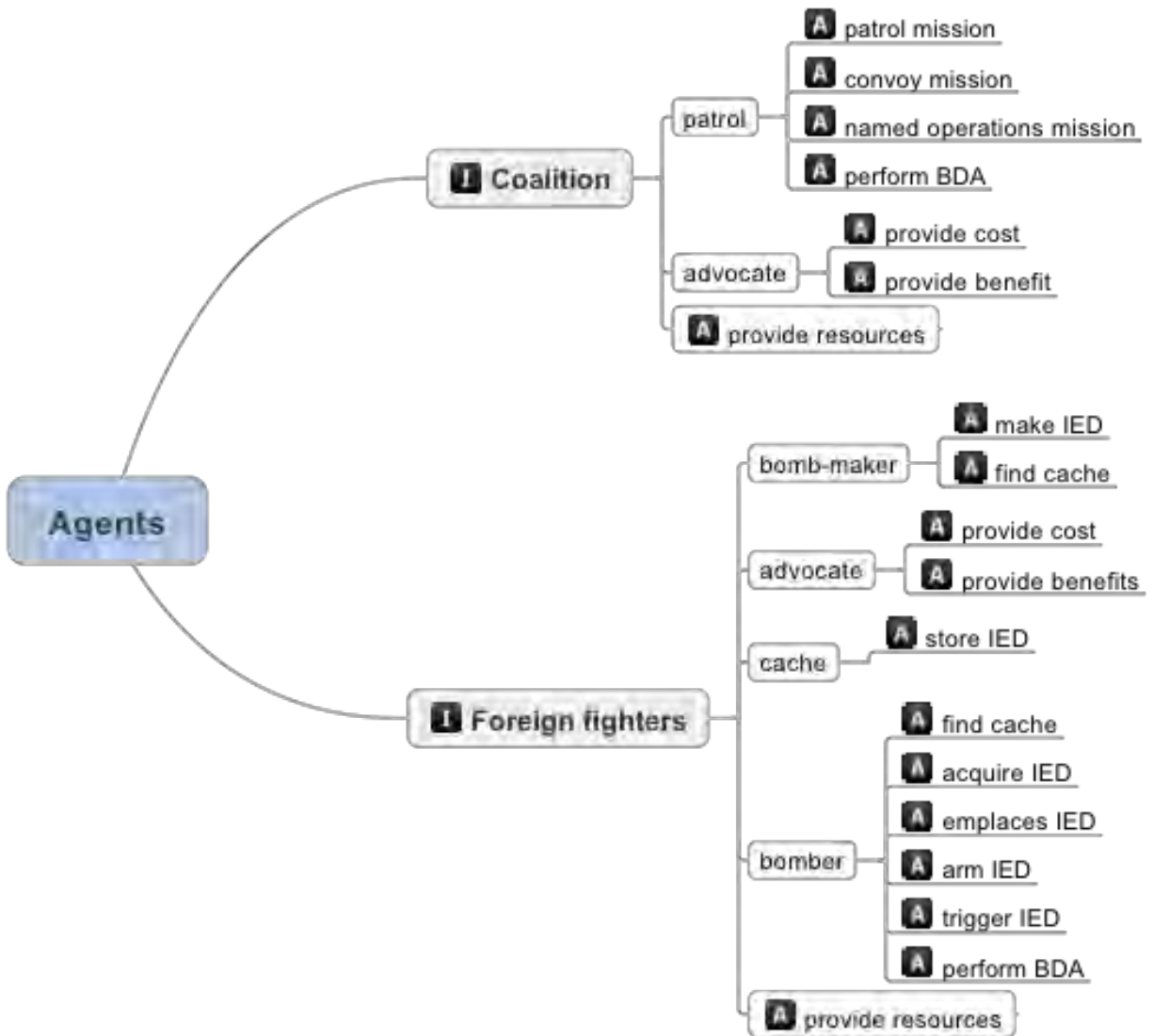
Figure 21: Foreign Fighter and Coalition actions

The interaction between members of the Coalition and Foreign Fighters will affect the number of IEDs that are actually emplaced and so detonated. Members of the local population can affect the number of IEDs emplaced by providing intelligence information to Foreign Fighters (RED HUMINT) or to the Coalition (BLUE HUMINT). Such actions will be taken by individuals who are (for example) pro-Coalition but with a risk aversion high enough to preclude them from taking jobs such as army, police, or government.

If an IED explodes, everyone (local population included) within the blast radius is a potential victim. Victims can be injured or killed. The blast radius is a function of the IED attack profile (flank or underbelly) and the amount of explosives it contains. There are several factors that affect the probability of being hit by the blast, such as the victim"s distance from the blast center and the type of bomb. Both the Foreign Fighters and the Coalition collect information about each IED event in a corporate memory.

Civilian deaths and injuries from IEDs and arrests/kidnappings from enforcement actions affect the victim"s value group, causing it to negatively adjust its stance towards the perpetrator. If we go back to Figure 11, which we reproduce here (see Figure 22) with modifications, we see how this change towards a more negative stance moves through the process and changes grievance levels and therefore what actions the individual is willing to take. Note that the individual"s risk attitude does NOT change. Conversely, if a group bestows benefits on another group or on an individual, the group"s or individual"s stance will adjust positively.
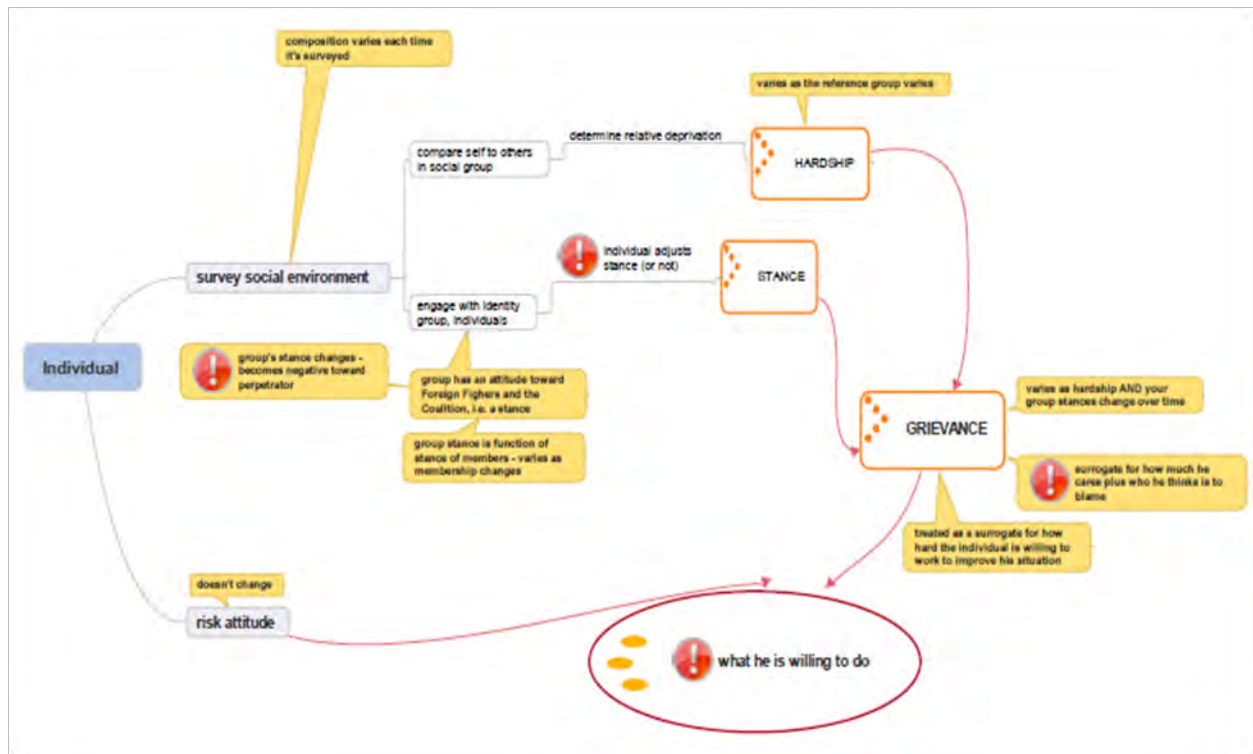

Figure 22: Change in propensity for violent action

Conclusion

As our story began with the local population, so does it end with the local population. The model is designed to show the impact of costs (including those resulting from violence) and benefits on the local population's attitudes towards the Coalition and Foreign Fighters, and how that will subsequently impact their action. COIN, after all, is about actions the local population takes within the context created by (in our case) the Foreign Fighters and the Coalition.

Our story is that an individual's perceived hardship, combined with his belief of who caused people he cares about to come to harm or receive benefits, and his inherent level of risk aversion will create a predilection for him to take certain types of actions. Environmental conditions include the Coalition's goal of reducing overall violence and reducing the number of members of the local population who join Foreign Fighter-affiliated groups, and the Foreign Fighters' goal of inflicting as much damage as possible on the Coalition while increasing the number of local population who join Foreign Fighter-affiliated groups. The model makes a suite of actions available to the members of the local population within this context, and the simulation shows how factors combine into scenarios and how those scenarios play out.

Our construction allows us to account for various phenomena that have contributed to the „messiness" and difficulty of prosecuting irregular wars. We also can account for the „accidental guerilla"[113] – the individual who has no particular ideological stance but who reacts to very locally imposed costs and who looks toward some insurgent group to help address his hardship (provide financial incentive, other economic opportunity, or other benefit). While this is arguably not the primary motive for most counterinsurgents, we do want to have this as a possibility. Our model also is able to account for the „good guy by day, bad guy by night" phenomenon that characterizes many irregular warfare environments. Since a member of the local population can belong to several groups simultaneously, he can hold what might appear to be contradictory beliefs simultaneously (e.g. pro-Coalition, pro-Foreign Fighter). Our model shows that he may belong to several groups as each provides him with a different or additional utility or benefit. As a result, we are able to differentiate (to some first order) among behaviors that may look the same but may be driven by different motivations. Our inclusion of the patron-client dynamic along with the dynamics of emergent groups shows how the initial distribution of resources can affect their ultimate disposition. And this is all acted out within an environment that is characterized by violent acts as well as more „normal" social engagement.

Our challenge problem is to *develop a computational representation of the interdependence between kinetic and non-kinetic aspects of a battlespace.* By developing relatively complex social actors who live in a rather rich environment, we can illustrate how various social and kinetic dynamics impact actors within that space.

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[113] See David Kilcullen. 2009. The Accidental Guerrilla: Fighting Small Wars in the Midst of a Big One. Oxford University Press. New York, NY

Glossary

Hardship – An individual determines if he is better or worse off than some reference group, i.e. he assesses his relative deprivation. This results in a determination by the individual of his hardship which thus is a perceived not an actual condition.

Stance - A stance is an expression by an individual of whether or not he holds some particular group responsible for his condition, whether his condition be good or bad.

Grievance - The combination of an individual"s hardship (determined as a function of his relative deprivation) and his stances will yield an individual"s grievance level. An individual"s grievance is a surrogate for how much he „cares" about his situation, combined with an assignment of responsibility that identifies whom he thinks is responsible for his situation

Risk attitude – the level of risk aversion assigned to an individual at the start of a model run. It holds constant throughout the run and is independent of the risk level of the activities in which he may be engaged.

Status group – based on structural homophily, where all actors in the group occupy the same structural position as defined by social roles. In our model the attributes of gender, marital status, wealth and age cohort are used to determine structural homophily.

Value group – based on value homophily, where all actors in the group have similar values and attitudes. In our model, the attributes of ethnicity, tribe, religion and nationality are used to determine value homophily.

Legitimacy – a populace"s perception (established over time) that the regime governing the populace has conducted its processes and procedures in a fair manner, where "fair" is defined by the populace.

Power – an instrumental or conditional means for shaping the behavior of others. Power is exercised either by threatening or using coercion to deter or change undesired behavior or by promising rewards to promote desired behavior.

Compliance – the level of congruity between a request and the actual action taken. High congruity would equal high power held by the actor issuing the directive.

Patron-Client Relationship – extra-legal dyadic relationships that facilitate a reciprocal exchange between individuals. One member of the dyad is always more powerful than the other, and the reciprocity involves different types of exchanges that occur at different times during the relationship.